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

Agricultural Engineering Management Engineering MSc Program

2023

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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.

# **INTERNATIONAL OFFICE AT THE FACULTY OF AGRICULTURAL AND FOOD SCIENCES AND ENVIRONMENTAL MANAGEMENT**

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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)

Agricultural Genomics and Biotechnology Center, Animal Genomics Research Team

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 Applied Plant Biology

Department of Crop Production, Applied Ecology and Plant Breeding

[**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 Use, Engineering and Precision**](http://www.agr.unideb.hu/etk/xsearch.php?optLang=en&lstDep=22203) **Farming Technology**

Department of Agricultural Engineering and Robotics

Department of Land Use

Department of Precision Technology

**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)

**Agricultural Laboratory Center**

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# **Department of Land Use**

# **Department of Precision Technology**

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**INSTITUTE OF NUTRITION**

138, Böszörményi str., Debrecen H-4032, Tel: +36-52-508-444 / 88433

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| **name, position** | **e-mail, room number** |
| Dr Endre MáthéAssociate Professor, Head of Institute | endre.mathe64@gmail.comroom V1, building D |
| Prof. Dr. Zoltán GyőriProfessor Emeritus | gyori.zoltan@unideb.huroom V9, building D  |
| Dr Péter SiposProfessor | siposp@agr.unideb.huroom V8, building D |
| Judit SzepesiAdministrative Assistant | szepesi@agr.unideb.huroom V1, building D |

#  **INSTITUTE OF PLANT PROTECTION**

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| Dr Szabolcs Szanyi Lecturer | szanyi.szabolcs@agr.unideb.hu room 217 A, building B |
| Dr Antal Nagy Head of Institute, Associate Professor | nagyanti@agr.unideb.huroom 218, building B |
| Dr Gábor TarcaliSenior Research Fellow | tarcali@agr.unideb.huroom 221.A, building B |
| Dr. Arnold SzilágyiAssistant Professor | szilagyi.arnold@agr.unideb.hu room 220, building B |
| Dr. Kitti Csüllög Assistant Professor | csullog.kitti@agr.unideb.huroom 221, building B |
| András CsótóDepartmental Engineer | csoto.andras@agr.unideb.huroom 223, building B |
| Ms. Györgyi Bíró FerencsiknéDepartmental Engineer | ferencsikne.gyorgyi@agr.unideb.huroom 219, building B |

**AGRICULTURAL LABORATORY CENTRE**

138, Böszörményi str., Debrecen H-4032, Tel: +36-52-508-444 / 88146

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| **name, position** | **e-mail, room number** |
| Dr Tünde PusztahelyiProfessor, Head of Center | pusztahelyi@agr.unideb.hu1st floor, building G |
| Dr Szilvia KovácsAssistant Research Fellow | kovacs.szilvia@agr.unideb.hubasement, building K-L |

**INSTITUTE OF WATER AND ENVIRONMENTAL MANAGEMENT**

138, Böszörményi str., Debrecen H-4032, Tel: +36-52-508-444 / 88146

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| **name, position** | **e-mail, room number** |
| Prof. Dr János TamásHead of Institute, Professor | tamas@agr.unideb.huroom 1, 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 |
| Dr Attila NagyAssociate Professor | attilanagy@agr.unideb.hu room 10, building N |
| Dr Csaba PregunAssistant Professor | cpregun@agr.unideb.hu room 12, building N |
| Dr. Péter Tamás NagyAssociate Professor | nagypt@agr.unideb.hu room 19, building N |
| Dr Tamás MagyarAssistant Professor | magyar.tamas@agr.unideb.huroom 14, building N |
| Dr. Imre BoczonádiAssistant Professor | boczonadi.imre@agr.unideb.huroom 12, building N |
| Dr. Zsolt FehérAssistant Professor | feher.zsolt@agr.unideb.huroom 14, building N |
| Dr. Edit GorliczayAssistant Professor | edit.gorliczay@agr.unideb.huroom 21, building N |
| Erika Budayné- BódiAssistant Lecturer | bodi.erika@agr.unideb.hu room 14, building N |
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| Imre Lászlóné HuszkaAdministrative Assistant | huszka.imrene.ildiko@agr.unideb.hu room 1, building N |

**ACADEMIC CALENDAR**

**University calendar of the academic year 2023/2024**

|  |  |
| --- | --- |
| **Academic year opening ceremony**  | 3rd September 2023 (Sunday)  |
| **1st semester study period:**  | 4th September – 1st December 2023 (13 weeks)  |
| 1st semester study period for **graduating** students:  | 4th September – 3rd November 2023 (9 weeks)  |
| **1st semester exam period:**  | 11th December – 22nd December 2023 (2 weeks) 8th January 2024 – 9th February 2024 (5 weeks)  |
| 1st semester exam period for **graduating** students:  | 6th November – 24th November 2023 (3 weeks)  |
| Thesis submission deadline  | 25th October 2023  |
| Departmental thesis defence  | 22nd – 23rd November 2023  |
| Final exam period  | 4th – 6th December 2023  |
| **2nd semester study period:**  | 19th February – 17th May 2024 (13 weeks)  |
| 2nd semester study period for **graduating** students:  | 19th February – 19th April 2024 (9 weeks)  |
| **2nd semester exam period:**  | 20th May – 5th July 2024 (7 weeks)  |
| 2nd semester exam period for **graduating** students:  | 22nd April – 24th May 2024 (5 weeks)  |
| Thesis submission deadline  | 26th April 2024  |
| Departmental thesis defence  | 22nd – 23rd May 2024  |
| Final exam period  | 10th – 12th June 2024  |

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

The academic calendar for the given semester can be found on the faculty's website: https://www.edu.unideb.hu/tartalom/downloads/University\_Calendars\_2023\_24/University\_calendar\_2023-2024-Faculty\_of\_Agricultural.pdf

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

INTRODUCTION OF THE PROGRAM

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

The MSc in Agricultural Environmental Management Engineering is designed to develop your undergraduate knowledge and improve it through application and research. The field of Agricultural Environmental Management Engineering is broad and the programme reflects this diversity, with emphasis on Natural Resource Management, Environmental Impact Assessment, Environmental Technologies, Environmental Informatics, which are the key research areas of the Department of Water and Environmental Management responsible for the course.

Throughout your stay at Debrecen University, which is the second largest university in Hungary, with 30 000 students, as a postgraduate student, you will have a personal academic tutor to guide you through your studies and to meet your individual goals and interests. We also offer you a 4 week field practice in summer.

Areas of Study: Public Administration, Organization Environmental Law, Natural Resource Management, Sustainable Agricultural Systems and Technologies, Land Use and Regional Planning, Environmental Impact Assessment, Environmental Laboratory Measurement Techniques, Ecotoxicology, Environmental Technologies, Nature Protection, Water Resource Management and Water Quality Protection, Landscape Management, Environmental and Quality Management, Environmental Informatics, Agri-Environmental Politics, Environmental Economy, Agricultural Remote Sensing, Agro-hydrology-Agricultural, Watershed Management, Precision Agriculture, Environmental Health, Agri-Environmental Protection.

Postgraduates may progress to PhD or find employment in Agricultural Environmental Management Engineering, lecturing, consultancy, or other sectors where Agricultural Environmental Management Engineering is involved.

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

|  |  |
| --- | --- |
| **Academic language skills**  | **MTM7NY1A** |
| **Agricultrual biotechnology** | **MTMKG8022A** |
| **Agricultural forestry and biomass production** | **MTMKG8015A** |
| **Agro-environmental management: Ecotoxicology, environmental risk assessment** | **MTMKG8020A** |
| **Air quality protection** | **MTMKG8025A** |
| **Applied hydrology and hydraulilcs** | **MTMKG8004A** |
| **Circular economy in agriculture** | **MTMKG8005A** |
| **Drought and excess water management, melioration** | **MTMKG8014A** |
| **Environmental chemistry** | **MTMKG8001A** |
| **Environmental impact assessment and environmental modeling** | **MTMKG8008A** |
| **Environmental informatics, environmental monitoring** | **MTMKG8003A** |
| **Environmental measurement techinques** | **MTMKG8012A** |
| **Environmental planning, land consolidation, landscape conservation** | **MTMKG8018A** |
| **Environmental policy, law and sectoral administration** | **MTMKG8021A** |
| **Environmental technologies I. Soil remediation, soil protection, biotechnology in agriculture** | **MTMKG8011A** |
| **Environmental technologies II. Aerobic and anerobic technological systems** | **MTMKG8013A** |
| **Farm business management and project management** | **MTMKG8019A** |
| **Internship** | **MTMKG8GYA** |
| **Natural sciences II. Nature conservation ecology** | **MTMKG8007A** |
| **Noise and vibration protection** | **MTMKG8026A** |
| **Physical and chemical methods of environmental technology** | **MTMKG8006A** |
| **Precision agriculture** | **MTMKG80010A** |
| **Professional language skills** | **MTM7NY2A** |
|  **Remote sensing** | **MTMKG8023A** |
| **Research metholgdology , scientific commuinication** | **MTMKG8024A** |
| **Soil physics and geohydrology** | **MTMKG8002A** |
| **Thesis preparation I.** | **MTMKG8D1A** |
| **Thesis preparation II.** | **MTMKG8D2A** |
| **Wasste management in agriculture and food industry** | **MTMKG8017A** |
| **Wastewater and slurry management** | **MTMKG8009A** |
| **Water quality management** | **MTMKG8016A** |

**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:**

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

**practices:**

|  |
| --- |
| 1. Academic writing, speaking, reading comprehension and listening comprehension
 |
| 1. Academic vocabulary building, writing, speaking listening and reading comprehension
 |
| 1. Presentation skills, reading comprehension and listening comprehension, academic writing
 |
| 1. Developing academic literacy, speaking, reading and listening comprehension,
 |
| 1. Speaking and presenting,, reading comprehension and listening comprehension tasks, and academic writing.
 |
| 1. The situational dialogues, reading comprehension and listening comprehension tasks, and writing a formal letter regarding a given topic
 |
| 1. A survey of the skills and knowledge acquired thus far
 |
| 1. Poster and presentation, reading comprehension and listening comprehension tasks, and academic writing.
 |
| 1. Effective presentation, reading comprehension and listening comprehension tasks, and academic writing
 |
| 1. Time management, critical thinking, reading comprehension and listening comprehension tasks, and writing essays.
 |
| 1. Presentation, reading comprehension and listening comprehension tasks, and academic writing
 |
| 1. Speaking and presentation, reading comprehension and listening comprehension tasks, and academic writing
 |
| 1. Essay writing, speaking, reading comprehension and listening comprehension
 |
| 1. 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.

**Applied hydrology and hydraulics MTMKG8004A**

**Name and title of the person responsible for the subject:**

**Additional instructors involved in teaching the subject:** Dr. Pregun Csaba, assistant professor, Dr. Kiss Nikolett Éva teaching assistant

**Name and level of the program:** Agricultural Water Management Engineering MSc

**Subject type:** obligatory

**Teaching timetable of the subject, type of examination:** 2+2K

**Credit value of the subject:** 4

**Purpose of teaching the subject:** 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, included 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.

**Content of the subject (14 weeks):**

1. The subject of hydrology, the water supply of the Earth, the circulation of water, the elements of the cycle. The hydrological cycle and its sub-processes.
2. Knowledge, measurement and description of primary elements of water balance (precipitation, evaporation, infiltration, run-off, ponding). Basic relationships of hydrological elements.
3. Hydraulic Basics I. (physical properties of liquids and hydrostatics)
4. Hydraulic Basics II. (flow laws, pressure flow, gravity flow, pump operation and regulation)
5. Basics of hydrodynamics 1. (closed pipeline water movements and groundwater movement)
6. Basics of hydrodynamics (knowledge of open surface water movements and groundwater movements)
7. Classification of watercourses. Types of river valley, type of stage, estuary types.
8. The formation and morphology of the lakes. Types of lakes.
9. Geometric parameters of the catchment areas, characterization of the catchment areas.
10. Cross section of watercourses, site analysis, types of sections.
11. The groundwater. Forms, characterization and classification of stratified waters.
12. Types and characterization of groundwater.
13. Groundwater contamination and treatment.
14. Characterization and classification of karstic waters. Types of springs.

**Summary of content – practice (14 weeks):**

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

**Type of mid-term examination:**

Written and/or verbal

**Method of assessment (semester examination mark - report, practical grade, colloquium, examination):**

The implementation of the practices. Missing the practice in accordance with the University of Debrecen Study and Exam Regulations. Active participation in exercises. Calculation exam task.

**Teaching aids:**

ppt presentations.

**Recommended 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

**Environmental Policy, Law and Sectoral Administration MTMKG8021A**

ECTS Credit Points: 3

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

Type of exam: colloquium

Requirements:

- for signature: Completing exercises, giving presentation and preparing a report.

- for a grade: Colloquium

**Summary of content – theory**

The general aim of the course is to increase the knowledge on rural development and agricultural policy in favour of environmentally responsible farming based on sustainable use of natural resources. Additionally, agricultural environmental management engineering students get information on agro- and environmental policies of the European Union and Hungary. Students understand the work of agricultural and environmental policy systems, and the connections among the different actions.

**lectures:**

1. History and future of the Common Agricultural Policy.
2. Common Agricultural Policy and rural development. SPS and SAPS systems, sectoral policies, organisation of agricultural market, cross-compliance.
3. Application of CAP at national level. Review of agricultural policy regulation for selected countries.
4. Definition and principles of agricultural policy. Tools of agricultural policy. The agricultural policy of the European Union.
5. Environmental protection and policy in Hungary.
6. National Environmental Protection Programmes.
7. Environmental policy and other related sectoral policies (climate, energy, transport, etc.)
8. Structural and institutional system of agricultural policy.
9. Environmental policy in the business sector, EP at company level.

**practices:**

1. Introduction into Agricultural Policy
2. Formulating Agricultural Policy in EU
3. Direct payment
4. Cross compliance
5. Agri-Environmental Scheme, measures
6. Agriculture and climate change
7. Organic Farming
8. Organic livestock production
9. Presentation and report

**Literature, handbooks**

[Tom Delreux](https://he.palgrave.com/authors/author-detail/Tom-Delreux/?sf1=name_exact&st1=TOMDELREUX&DS=Tom%20Delreux), T.-[Sander Happaerts](https://he.palgrave.com/authors/author-detail/Sander-Happaerts/?sf1=name_exact&st1=SANDERHAPPAERTS&DS=Sander%20Happaerts), S.:(2016). Environmental Policy and Politics in the European Union. Palgrave. 320.p. ISBN: 9780230244269.

Jordan, A.-Adelle, C.:(2012). Environmental Policy in the EU: Actors, institutions and processes. Rautledge, Abington. 392.p. ISBN: 978-1849714693

OECD (2016), Agricultural Policy Monitoring and Evaluation 2016 (Summary), OECD Publishing, Paris. 136.p. ISBN: 9789264253537 (PDF); 9789264259126 (EPUB); 9789264208933 (print).

Tangermann, S.-von Cramon-Taubadel, S.:(2013). Agricultural Policy in the European Union. Universität Göttingen. 75.p. ISSN 1865-2697.

Tropea, F.:(2016). Common Agricultural Policy 2014- 2020. European Parliamentary Research Service. 36.p. ISBN: 978-92-823-9357-4.

**Agricultural Forestry, MTMKG8015A**

ECTS Credit Points: 3

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

Type of exam: exam mark

Requirements:

- for signature: Attending the lectures and practices. Completing exercises, submitting essay.

- 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 aim of the course is to provide basic knowledge on the priorities and tasks of forest management as well as on the main management directions and forest administration.

 **lectures:**

1. Priorities and characteristics of forest management.
2. Criteria of forest site classification.
3. Ecological and silvicultural characteristics of the main stand-forming tree species.
4. Forest tree improvement and forest stand establishment techniques.
5. Agro-forestry systems.
6. Nature-like forest management.
7. Wood utilization and forest subsidiary use.
8. Introduction to forest mensuration.
9. Forest administration and forest management planning.

**practices:**

 Identify common tree species.

1. Identify the abiotic and biotic factors in a forest ecosystem.
2. Introduction to forest breeding and improvement.
3. Know the plant propagation material management.
4. Understand silvicultural terms, and be able to explain the uses of the following techniques: cleaning, thinning, shelterwood, clearcutting.
5. Explain the plantation forestry and agro-forestry techniques.
6. Explain the nature-like forest management techniques.
7. Know how to use forestry tools and equipment in order to measure single trees and forest stands.
8. Understand why trees and forests are important to recreation, wildlife, and watershed quality.

**Literature, handbooks**

Hibberd, B. G. ed. 1986: Forestry Practice. Forestry Commission Bulletin. 14. London, pp. 104. (ISBN 0 11 710156 7).

Savill, P. et al. 1997. Plantation Silviculture in Europe. Oxford University Press. pp 297.

(ISBN 0 19 854909 1).

West, P.W. 2006. Growing Plantation Forests. Springer. pp.303. (ISBN-13 978-3-540-32478-2).

**Agro-environmental management II-Ecotoxcicology, environmental risk assessment, MTMKG8020A**

ECTS Credit Points: 4

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

Type of exam: written exam

Requirements:

- for signature: Submitting reports 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: Essay type written exam is taken in the examination period of the semester focusing on the knowledge gained. List of the topics is provided below.

**Summary of content – theory**

Fulfilling the course, students will know the potential sources of environmental risks, factors determining and controlling the exposition and transport processes within the ecological systems, and the methodology of environmental risk analysis, assessment and management. The students will be familiar with the EU legislation related to the use of environment, and risk assessment for the sectors of agriculture and food industry, and the relevant best available techniques. As a result of completing practical tasks, they will have the skills to identify the relations between ecotoxicology and environmental risk assessment and management, to measure and interpret proper data and information, as well as to carry out scenario analyses using selected software, required to the ERA. Study trips will also serve to understand the link between theory and practice. Practical tasks serve to apply the theoretical knowledge on ecotoxicology and ERA, as well as to improve skills on software use and reporting, including the followings: mass and energy balances for the agricultural and food sectors; transport modelling and scenario analyses; chemical analyses for selected pollutants in environmental samples, data interpretation linked to ERA, visualization by GIS tools; study trip to natural and agricultural sites where activities posing potential environmental risk are carried out; study trip to sites after clean-up and rehabilitation.

**lectures:**

1. Ecotoxicology – potential pollutants in the environment, fate and transport of pollutants in the ecological systems, expositions
2. Ecotoxicological tests
3. Licensing of new chemicals
4. Environmental risk assessment methodology
5. Transport processes and their modelling in soil and ground water
6. EU legislation for environmental risk assessment (ERA), reduction and management
7. Best available – environmentally responsible – techniques in the agriculture and food industry
8. Planning and designing clean-up technologies based on ERA
9. Latest scientific results in the area of ecotoxicology

**Summary of content - practice**:

Students will practice the implementation of principles, and application of procedures as well as interpretation methods in the field of environmental risk assessment and ecotoxicology in the form of individual case studies using data measured in laboratory and modelling in IT environment.

**practices:**

1. Finding link between environmental/ecological risk assessment and the characteristics of artificial stressors, including their fate and transport in the environment.
2. Assessment of environmental impacts related to a case study using matrices.
3. Assessing conditions for best available techniques (BAT) for a given agriculture related activity.
4. Investigation in the application of the principles of cleaner production (CP).
5. Hydrogeological modelling in IT environment, modelling an unconfined aquifer system with discharge and recharge
6. Carrying out scenario analyses in the hydrogeological modelling
7. Assessing clean up technologies and processes to a case when an accident in production or transportation happens, related to a company in the agriculture and food industry sectors.
8. Laboratory analyses for soil and water samples; measuring parameters considerable from the point of contamination transport; and assessment of the meaning of the values from environmental point of view.
9. Finding the latest scientific articles in relation to environmental risk assessment and management

**Literature, handbooks**

[Whitacre, David M.](http://www.prospero.hu/katalogus/kereso/?form_submit=1&szerzo=Whitacre+David) (2015): Reviews of Environmental Contamination and Toxicology. [Reviews of Environmental Contamination and Toxicology](http://www.prospero.hu/katalogus/kereso/?form_submit=1&cim=Reviews+Environmental+Contamination+and+Toxicology); [225](http://www.prospero.hu/katalogus/kereso/?form_submit=1&cim=225). Springer Verlag. 144 p. ISBN-13: 9781489988201

[Newman, Michael C](http://www.prospero.hu/katalogus/kereso/?form_submit=1&szerzo=Newman+Michael). (2014): Fundamentals of Ecotoxicology. The Science of Pollution, Fourth Edition. CRC Press. 680 p. ISBN-13: 9781466582293

Áine Gormley, Simon Pollard, Sophie Rocks: Guidelines for Environmental Risk Assessment and Management. Cranfield University, 2011: <https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/69450/pb13670-green-leaves-iii-1111071.pdf>

Best available techniques – guidelines: <http://eippcb.jrc.ec.europa.eu/reference/>

<http://eippcb.jrc.ec.europa.eu/reference/BREF/IRPP_Final_Draft_082015_bw.pdf>

Exercise book: Practical exercises for the course of agro-environmental management II - ecotoxicology, environmental management

**Circular economy in agriculture, MTMKG8005A**

**Name and title of the person responsible for the subject: Dr Nikolett Szőllősi, assistant professor**

**Additional instructors involved in teaching the subject: -**

**Name and level of the program: Agricultural Environmental Management Engineering MSc**

**Subject type: obligatory**

**Teaching timetable of the subject, type of examination: 2+1 G**

**Credit value of the subject: 3.**

**Purpose of teaching the subject: During the semester students get information about environmental impact of different agricultural activities and related economical issues. In addition students get a point of view of near natural and cleaner solutions in agribusiness sector and related economical issues. There will be intoroduction into circular economical solutions in different agricultural sectors and related economical issues by case studies.**

**Content of the subject (14 weeks):**

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. Intoduction into circular economy. Importance, benefits. Circular economical solutions and related economical issues.
4. Intorduction into Environmental Management at company level
5. Environmental Management tools at company level.
6. Role of LCA in circular economy. Case studies.
7. The role of ISO 14 001 and EMAS in circular economical practice
8. Corporate Social Responsibility, environmental communication, sustainability report. Case tudy.
9. Intorduction into farm management. Environmental issues of agricultural activities, crop production. Solutions for agri environmental practices, economical issues.
10. Environmental issues of agricultural activities, animal husbandry. Solutions for agri environmental practices, economical issues.
11. Waste management of agricultural activities, crop production. Solutions for near natural and cleaner technologies and related economical issues.
12. Waste management of agricultural activities, poultry production. Solutions for near natural and cleaner technologies and related economical issues.Introduction into near natural and cleaner technologies
13. Role of water in circular economy.

**Type of mid-term examination: exercises**

**Method of assessment (semester examination mark - report, practical grade, colloquium, examination): practical grade**

**Teaching aids:**

**Recommended literature:**

1. Lennart Nilsson, Per Olof Persson Lars Rydén, Siarhei Darozhka Audrone Zaliauskiene (2007): Cleaner Production Technologies and Tools for Resource Efficient Production. The Baltic University Press. ISBN 91-975526-1-5. 319. p.
2. Andrew Woodend 2010. Definitions of Terms used in Farm Business Management. Department for the Environment, Food and Rural Affairs, Crown Copyright. p. 47.
3. Paul Ekins, Teresa Domenech, Paul Drummond, Raimund Bleischwitz, Nick Hughes, Lorenzo Lotti (2019): The Circular Economy: What, Why, How and Where. OECD Centre for Entrepreneurship, SMEs, Regions and Cities.82. p.
4. European Comission (2020): Circular Economy Action Plan. 27. p.

**Drought management, MTMKG8014A**

ECTS Credit Points: 3

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

Type of exam: practical course mark in 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, submitting report at the end of the semester.

- 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 make students understand and apply the practical application of drought management, including the following: 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 of plant water supply for irrigation systems. As a result of completion of 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 is to get the agricultural environmental management engineering MSc students acquainted with the main drought management plans, drought stress monitoring and a method for measurement and calculation of evapotranspiration. The exercises provide advanced knowledge on drought monitoring techniques, plant water supply for irrigation systems. As a result of completion of 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 of 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 chemistry, MTMKG8001A**

**Name and title of the person responsible for the subject:** Péter Tamás Nagy (PhD)

**Additional instructors involved in teaching the subject:**

**Name and level of the program:** Agricultural Environmental Management Engineering MSc

**Subject type:** compulsory

**Teaching timetable of the subject, type of examination:**2+2 practical grade

**Credit value of the subject:** 4

**Purpose of teaching the subject:**

It introduces students to laboratory and rapid analytical methods used in environmental chemistry and analysis. Students will be able to determine the quality and the quantity of different environmental samples, and thus the likely impact of environmental pollution and its hazardousness, and to decide on the need for intervention. They will acquire specific knowledge on the analytical background and the use of agricultural and food wastes and by-products for biogas and composting. They will gain useful knowledge on the theory of ecotoxicology.

Become familiar with the laboratory analysis of environmental samples from agriculture and food industry and in the selection of the necessary treatment and recovery methods. Students will be able to actively participate in team work and thus be involved in research and development research and development projects.

**Content of the subject (14 weeks):**

1. Introduction to environmental chemistry /lab safety
2. Global environmental status of the world/lab equipment, devices
3. Global environmental problems, circles/ balances and volume measuring devices
4. Environmental chemistry/chemical calculations
5. Water chemistry I./making solutions, determination of different water parameters I.
6. Water chemistry II./sampling methods, determination of different water parameters II.
7. Test writing
8. Field trip I.
9. Soil chemistry I./classical analytical methods, introduction to titrimetry
10. Soil chemistry II./ sampling methods, determination of different soil parameters I.
11. Air chemistry I./ sampling methods
12. Field trip II.
13. Test writing
14. Case studies in environmental chemistry

**Type of mid-term examination:**

2 mid-year exams. Attendance of the practices, keeping a practical diary. Being active in group works; Completing lab works; Taking part in field visits

**Method of assessment (semester examination mark - report, practical grade, colloquium, examination):** practical grade is based on oralreport is taken in the examination period of the semester focusing on the knowledge gained. Submitting reports in due time, successful mid-year exams, taking part actively in the practices and field trips and completing home work individually are compulsory.

**Teaching aids:** ppt presentations, online websites, Practical exercises of the course

**Recommended literature:**

Williams, Ian. Environmental Chemistry, A Modular Approach. Wiley. 2001. ISBN 0-471-48942-5.

Stanley E Manahan. Environmental Chemistry. CRC Press. 2004. ISBN 1-56670-633-5.

**Environmental impact assessment and environmental modeling, MTMKG8008A**

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 is a successful fulfillment of the tasks defined by the lecturer.

- for a grade: Completing assignments / exercises, submitting essay, giving presentation, written exam.

**Summary of content – theory**

The aim of the subject is to have the basic concepts of environmental modeling acquainted with students, to give an inspection into the operation practice of models connected to soil-water-air-pollution. Students get acquainted with the major application possibilities regarding the environmental aspects of modeling systems. Students learn the human- and ecotoxicological risk assessment.

**lectures:**

1. Principles of modeling
2. Importance of environmental risk assessment
3. Characteristics of soil plant atmosphere system
4. Modeling of the impacts on soil and groundwater effects
5. Modeling of the impacts on surface water effects
6. Modeling of the impacts on atmosphere effects
7. Modeling of the impacts on biomass and landscape effects
8. Modeling of the impacts on the human health effects
9. Socio-economic consequence of the impacts on the environmental effects
10. Preparing of environmental impact studies
11. Practical application of pollution transmission models, processing of remediation and monitoring
12. Remediation of soil, groundwater and surface water
13. Cost-benefit analysis of remediation
14. Development of simulation and modelling software

**practices:**

1. Surfer GUI
2. Surfer colour management
3. Surfer data management
4. Grid DEM
5. Data importing
6. Basic Data statistics
7. DAT data types
8. Griding methods
9. Grid report evaluation
10. Accurate interpolations
11. IDW, TIN
12. Global interpolations
13. Kriging
14. Error propagations

**Literature, handbooks**

Adolf, E., Teimuraz, D. (2007): Air, Water and Soil Quality Modelling for Risk and Impact Assessment. Springer Verlag. 365 p.

Colombo, A. G. (2012): Environmental Impact Assessment. Springer Verlag. 334 p.

Bastmeijer, K., Koivurova, T. (2008): Theory and Practice of Transboundary Environmental Impact Assessment. Martinus Nijhoff Publishers. 397 p.

Wathern, P. (2013): Environmental Impact Assessment. Theory and Practice. Routledge (Taylor and Francis Group). 352 p.

GoldenSoftware(2018) Surfer Manual https://www.goldensoftware.com/products/surfer

**Environmental informatics – Environmental monitoring MTMKG7003A**

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 fulfillment of the tasks defined by the lecturer.

- for a grade: Completing assignments / exercises, submitting essay, giving presentation. Written exam.

**Summary of content – theory**

Students are acquainted with and master the renewable and non-renewable natural resources and geospatial assessment, change detection, the theory and practise of spatial decision support systems. They will be able to work in their environmental management work and operate geospatial and remote sensing software. They acquire knowledge related to enhancing environmental monitoring systems.

 **lectures:**

1. Local and international environmental geospatial projects.
2. Environment information systems on the Internet, data warehouses and metadata
3. The construction and operation of environmental management information systems, environmental elements and related IT tasks
4. Characterization, collection and data structures of digital environmental management data related requirements.
5. Modelling the environment.
6. Modelling soil and water
7. Hydrology environmental models
8. Surface and groundwater modelling
9. Landscape protection and landscape evaluation models
10. Space and time change assessment - Geostatistics basics
11. Basics of Remote Sensing.
12. Geoinformatics model of single-factor decision-making systems.
13. Applied, complex multi-factor decision-making systems.
14. Decision support modelling solutions

**practices:**

1. Surfer GUI
2. Surfer colour management
3. Surfer data management
4. Grid DEM
5. Data importing
6. Basic Data statistics
7. DAT data types
8. Griding methods
9. Grid report evaluation
10. Accurate interpolations
11. IDW, TIN
12. Global interpolations
13. Kriging
14. Error propagations

**Literature, handbooks**

Janardhana Raju et al. (2015) Management of natural resources in a changing environment. Springer Publ. ISBN 9783319125589

Lichtfouse E. Goyal A. (2015) Sustainable Agriculture Reviews 16. Spriger Publ. ISBN 9783319169873

GoldenSoftware(2018) Surfer Manual https://www.goldensoftware.com/products/surfer

**Environmental planning, land consolidation, landscape conservation, MTMKG8018A**

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, is a successful fulfilment of the tasks defined by the lecturer. Submitting essay, giving presentation.

- for a grade: Written exam

**Summary of content – theory**

The general aim of the subject is to present the purposes and the practice of landscape conservation and planning for the students. The role and position of the subject in environmental management, the technologies and methodologies of land consolidation and landscape conservation will be presented during the course. Students will learn the national and international land use systems. This knowledge provides land consolidation, land registration and land evaluation skills in the practice.

**lectures:**

1. Environment planning
2. National and international projects, information systems on the Internet, data warehouses and metadata.
3. Planning strategies, the aim of planning process: protection, rehabilitation, development
4. Landscape level planning – ecological networks, water network, green areas, artificial surfaces
5. Land use categories in the EU (CLC-100)
6. Land registration and land evaluation
7. Agricultural land use, land consolidation
8. Land use modeling: site-optimization, multi-purpose land allocation
9. Land change evaluation

**Summary of content - practice**:

The general aim of the practice is that students get to know modern landscape management. Students adopt landscape architecture, determine landscape indexes, make soil moisture calculation, learn the practical application of pF curve in horticulture.

**practices:**

1. Calculation of landscape indexes.
2. Site evaluation of agroforestry area.
3. Site evaluation of constructed wetland.
4. Greenness program in practise
5. Field exercise/farm visit hillside area.
6. Field exercise/farm visit agroforestry area.
7. Field exercise/farm visit energy plantation.
8. Field exercise/farm visit constructed wetland.
9. Consultation about compulsory practical report.

**Literature, handbooks**

Bishop, D., Lange, E. (2005): Visualization in landscape and environmental planning. Taylor and Francis. 320 p. (ISBN: 978-041-530-510-5)

Magueire, D. J., Goodchild, M. F., Batty, M. (2005): GIS, Spatial Analysis and Modeling. Esri Press. 480 p. (ISBN: 975-158-948-130-5)10: 0-615-22838-0.

**Environmental technologies I. Soil remediation, soil protection, biotechnology in agriculture, MTMKG8011A**

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: Participation at the field trip and active participation the practical lessons (at least 8), completing exercises, submitting report at the end of the semester, 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 detail. 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

2-3. 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. Analyzing 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

12-14 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

**Environmental technologies II - Water Quality Protection, Sewage Treatment, Waste Management in Agriculture and Food Industry, MTMKG8013A**

ECTS Credit Points: 3

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

Type of exam: written exam

Requirements:

- for signature: Participating in the exercises, successful written examination paper , giving presentation.

- for a grade: Written (Quizzes & Essays) exam.

**Summary of content – theory**

The purpose of the course is to acquaint students with the goals, concepts and tools of water quality protection, waste water treatment and waste management. They learn about methods of water qualification and water quality control, sources and forms of water pollution, methods of water treatment, quality and quantity protection and restoration of waters & watercourses. They acquire knowledge about the management, utilization and disposal of agricultural and food waste and by-products.

**lectures:**

1. The concept and purpose of water quality protection, the methods of water quality control and the legal background. Water quality parameters.
2. Human intervention in the river basin. Water pollution and hydromorphological regulations.EU and international methods of water qualification (physical, chemical, biological & ecological water qualification)
3. Rehabilitation of surface water bodies in the river basin. Self-purification of water.
4. Pollution and protection of groundwater bodies. Water resources protection.
5. Purpose and degree of wastewater purification; the generation and characterization of waste water. Mechanical (primary) sewage purification
6. Ecological and microbiological basics of biological wastewater purification, aerobic and anaerobic sewage purification processes; activated sludge and trickling filters, biological nitrogen and phosphorus removal; digesters.
7. Natural sewage treatment technologies. Lagoon sewage purification systems; Natural aquatic plant systems, & Constructed Wetlands.
8. The communal waste management. The role of waste management in agriculture and the food industry; Types, grouping, quantity and agricultural utilization of communal, agricultural and food waste and by-products.
9. Composting technologies based on agricultural and food raw materials and sewage sludge.
10. Biogas production technologies based on agricultural and food raw materials and sewage sludge.
11. Hazardous waste from agriculture and food industry (pesticides, slaughterhouse waste, etc.);
12. The burning and pyrolysis of communal, agricultural and food waste and sewage sludge.
13. Waste disposal – landfill

**Summary of content - practice**:

The general purpose of the practice is to provide students with knowledge on the operation of water quality, wastewater treatment and waste management technologies, the safe use of equipment, instruments used in environmental ratings, accident prevention role in field, plant and practical work.

**practices:**

1. Accident prevention and work safety knowledge
2. Methods and means of field sampling 1.
3. Purchase, conservation and pre-treatment of biological and water samples, on-site measurements and tests (weather, etc.)
4. Analysis of field water samples. : Organoleptic Effects of Water Pollution
5. Biological water qualification. Classification of water pollutants
6. Basics of Hydrological and Water Quality Modelling, Hydrological, Morphological and Water Physics. River Water Quality
7. Basics of hydrological and water quality modelling biological and water chemistry. Introduction and application to the HEC-Ras model
8. The Debrecen Wastewater Treatment Plant, the Water Treatment Plant in Balmazújváros and the Eco centrum of Lake Tisza visit (8-10 hours)
9. Planning of Dorr settlers. Sewage treatment plant. Complex sewage treatment
10. Calculation of weighing scales in waste management and sewage treatment. Material flow chart.
11. Composting Quizzes
12. Analysis of the efficiency of wastewater treatment (Excel) Complex sewage treatment.
13. Examination of water quality and hydrological time series (Excel) Using regression, factor and cluster analysis through a practical example.
14. Establishment of a landfill. Isolation of a non-hazardous (municipal) landfill.

**Literature, handbooks**

The curriculum (ppt or pdf format) is available to the student.

Federal Interagency Stream Restoration Working Group (FISRWG) (10/1998). Stream Corridor Restoration: Principles, Processes, and Practices. GPO Item No. 0120-A; SuDocs No. A 57.6/2:EN3/PT.653. ISBN-0-934213-59-3.

T. H. Christensen: Solid Waste Technology & Management, Volume 1 & 2. Blackwell Publishing Ltd 2011. Print ISBN: 9781405175173. Online ISBN: 9780470666883.

M. R. Templeton, D. Butler: An Introduction to Wastewater Treatment. Ventus Publishing 2011. ISBN 978-87-7681-843-2

**Farm Business Management and Project Management, MTMKG8019A**

ECTS Credit Points: 3

14 hour(s) lecture and 28 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 basic 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

**Summary of content - practice**:

Thinking in system approach and connect different aspects

**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.

**Natural sciences II: Nature conservation ecology, MTMKG8007A**

ECTS Credit Points: 4

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

Type of exam: Colloquium

Requirements:

- for signature: Regular visits to lectures, successful completion of the lectures, the practical examinations and the fulfilment of individual tasks.

- for a grade: Colloquium in the Examination Period: Anyone who has obtained the examination privilege may take an oral or written examination under the specified conditions during the examination period, the result of which is not influenced by the grade obtained in practice. A total of 3 examinations per semester, of which a possible third (“C”) exam will only be conducted orally before the Examination Board.

**Summary of content – theory**

In this subject, there is a special focus on the development of students' general awareness and correct ecological approach. The ecological concept of the biotic environment and the levels of ecological organization are also part of the curriculum. In addition to the above, they are familiarised with the national system of nature conservation and its most important values.

**lectures:**

1 The system of biotic environmental factors. Population Ecology. The structure of populations, factors that regulate the population.

2. Regulatory mechanism of population numbers, r and K-type selection. Graduation.

3. Intra- and interspecific interactions.

4. Community Ecology. Structure and change of communities.

5. Food chains, food networks. Material and energy flow in bio-cenosis.

6. The habitat of living beings. Basics of biogeography. The Pannon biogeographical region.

7. Biodiversity. Types, measurement, protection of biodiversity. Concept of ecological footprint.

8. Concept, purpose, principles and system of symbols of nature protection. Green Days.

9. International regulation of nature conservation.

10. Nature conservation value groups. Geological, aquatic values ​​and protection

11. Protection of their wild plant and animal associations.

12. Area-protected natural values

13. International Conservation Conventions

 14. Nature Conservation Regulation in the European Union

**Summary of content - practice**:

During the practice students will learn and will be able to apply in practice the specific system of ecological organizational levels and the ecological relationships of living communities. The introduction of anthropogenic impacts on living communities based on the principle of "think globally, act locally" is particularly important. In addition to ecological approach, they gain insight into certain elements of domestic and international nature conservation practices.

**practices:**

1. Evaluation of biotic factors- general field methods
2. Examples for actual projects of nature conservation management in Hungary
3. Migration types, the protection of migratory species
4. The elements and endangering factors of water circle
5. Impact studies about global warming and climate change
6. Taxonomy and protection of geological values
7. Taxonomy and protection of hydrological values
8. Taxonomy and protection of botanical values
9. Taxonomy and protection of zoological values
10. Area-protected natural values in Hungary
11. Area-protected natural values internationally
12. Endemic and relic species in the Pannon biogeographic region
13. Nature Conservation Regulation in the EU: the Natura 2000 system
14. Ex-situ Nature Conservation- a Field trip in the Zoo of Debrecen

**Literature, handbooks**

Begon M. , Harper J.L., Townsend C.R. (1996): Ecology- Individuals, Populations and communities, Blackwell Science, ISBN: 0-632-03801-2

Otero C., Bailey C. (2003): Europe’s Natural and Cultural Heritage, Friends of the countryside, ISBN: 84-607-9790-2

Voloscuk I. (ed). (1999): The National Parks and Biosphere Reserves in Carpathians-The last nature paradise, ACANAP, Tatranská Lominca, Slovak Republic, ISBN: 80-88680-31-X

**Physical and chemical environmental technology, MTMKG8006A**

**Name and title of the person responsible for the subject:** Dr. Tamás Magyar, senior lecturer

**Additional instructors involved in teaching the subject: -**

**Name and level of the program:** Agricultural Water Management Engineering MSc

**Subject type:** compulsory

**Teaching timetable of the subject, type of examination:** 3+2 K

**Credit value of the subject:** 5

**Purpose of teaching the subject:** The aim of the subject is to familiarize the students with the basic mechanical, biological, chemical and thermal environmental processes, as well as their theoretical and practical foundations, including mainly material processing technologies for soils and waste materials originated from the agriculture.

**Content of the subject (14 weeks):**

1. Basics of environmental technology (classification of processes)
2. Physical (mechanical) environmental technologies – Comminution
3. Physical (mechanical) environmental technologies – Agglomeration
4. Physical (mechanical) environmental technologies – Separation I.
5. Physical (mechanical) environmental technologies – Separation II.
6. Physical (mechanical) environmental technologies – Sorting and processing technology for recyclables.
7. Chemical environmental technologies - absorption; adsorption; precipitation; ion exchange; solid phase selective extraction.
8. Biological environmental technologies – Handling and processing of biodegradable wastes.
9. Basics of thermal processes: incineration, pyrolysis.
10. Chemical and biological characterization of wastewaters.
11. Chemical characterization of plastics.
12. Chemical characterization of soils.
13. Test

**Type of mid-term examination:** Test

**Method of assessment (semester examination mark - report, practical grade, colloquium, examination):** Colloquium

**Teaching aids:** Presentation materials.

**Recommended literature:**

1. Basanta Kumara Behera, Ram Prasad (2020): Environmental Technology and Sustainability - Physical, Chemical and Biological Technologies for Clean Environmental Management. 1st Edition, Elsevier. Paperback ISBN: 9780128191033, eBook ISBN: 9780128191040.
2. Vineet Kumar, Manish Kumar (2022): Integrated Environmental Technologies for Wastewater Treatment and Sustainable Development. 1st Edition, Elsevier. Paperback ISBN: 9780323911801, eBook ISBN: 9780323984850.
3. Abu Zahrim Yaser (2020): Advances in Waste Processing Technology. Springer. ISBN 978-981-15-4821-5. <https://doi.org/10.1007/978-981-15-4821-5>

**Precision agriculture, MTMKG8010A**

**Name and title of the person responsible for the subject: Dr Nagy Attila, associate professor**

**Additional instructors involved in teaching the subject:**

**Name and level of the program: Agricultural Engineer in Environmental Management MSc**

**Subject type:** compulsory

**Teaching timetable of the subject, type of examination: 1+2 G**

**Credit value of the subject: 3**

**Purpose of teaching the subject:** 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.

**Content of the subject (13 weeks):**

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 Sensors, monitors, additional instruments
7. Precision plant protection
8. Precision nutrient management
9. Precision water management
10. Precision horticultural
11. Precision animal husbandry
12. Yield monitoring, site specific information after harvest
13. Economical aspects of precision agriculture

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.

1. Jobcomputer – 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

**Type of mid-term examination:**

**Method of assessment (semester examination mark - report, practical grade, colloquium, examination):** Written exam

**Teaching aids:**

**Recommended literature:**

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:**

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

**practices:**

|  |
| --- |
| 1. Profession-related writing, speaking, reading comprehension and listening comprehension
 |
| 1. Profession-related vocabulary building, writing, speaking listening and reading comprehension
 |
| 1. Presentation skills, reading comprehension and listening comprehension, profession-related writing
 |
| 1. Developing profession-related literacy, speaking, reading and listening comprehension,
 |
| 1. Speaking and presenting,, reading comprehension and listening comprehension tasks, and profession-related writing.
 |
| 1. The situational dialogues, reading comprehension and listening comprehension tasks, and writing formal letters on a given topic
 |
| 1. A survey of the skills and knowledge acquired thus far
 |
| 1. Presentation, reading comprehension and listening comprehension tasks, and profession-related writing.
 |
| 1. Profession-related conversation, reading comprehension and listening comprehension tasks, and profession-related writing
 |
| 1. Profession-related conversation, critical thinking, reading comprehension and listening comprehension tasks, and writing essays.
 |
| 1. Presentation, reading comprehension and listening comprehension tasks, and profession-related conversation writing
 |
| 1. Speaking and presentation, reading comprehension and listening comprehension tasks, and profession-related conversation writing
 |
| 1. Essay writing, speaking, reading comprehension and listening comprehension
 |
| 1. 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, MTMKG8023A**

ECTS Credit Points: 3

1. hour(s) lecture and 42 hour(s) seminar per semester

Type of exam: practical course mark

Requirements:

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

- 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 with 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

**Research methodology - scientific communication, MTMKG8024A**

ECTS Credit Points: 5

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

Type of exam: exam

Requirements:

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

- for a grade: Essay type written exam is taken in the examination period of the semester focusing on the knowledge gained. List of the subjects is provided below.

**Summary of content – theory**

Fulfilling the course, students will be able to formulate problems at the level of R+D, will be capable of determining potential scientific alternatives for their solutions and working out proper research plans. The students will know and will be able to plan the proper conditions required for efficient research. As part of the course, statistical data analyses as methods will be learned and applied in specific case studies. Environmental statistics is incorporated into research planning and input and output data assessment. In addition, students will be familiar with the written communication forms of new scientific results and conclusions to different target groups, and they will be able to develop this skill via selected types of writings of scientific articles under guidance and continuous share of opinions and scientific argument. Practical tasks serve to apply the theoretical knowledge on research methodology, ideally, based on the subject of the BSc thesis, which are required to formulate potential approaches at the level R&D&I and develop scientific directions of research. To improve the written communication skills on scientific work and results, students will write an original article, a review and a short study for the public on any agro-environmental issues.

**lectures:**

1. Evolution of science, science classification
2. Types and characteristics of scientific research (basic, applied; qualitative, quantitative; descriptive, analytical)
3. Research methodologies (empirical, theoretical; logical, comparative)
4. Process and steps of scientific research, terms of efficient, high-quality research
5. Data and information sources, literature review techniques
6. Problem formulation, hypothesis, objectives, evaluation methods
7. Mathematical methods, research designing
8. Modelling, scientific model types and applications
9. Sampling strategies, statistical bases of environmental sampling
10. Cumulative and probability distribution functions, one sample and two sample t-tests, paired difference test, variance analysis, nonparametric tests
11. Relationships in the environment: correlation, regression
12. Data and information visualization techniques
13. Communication tools for scientific results and conclusions, structures of scientific articles (original article, review, short study for the public)
14. Measures of scientific performance, ethical issues in science

**Summary of content - practice**:

Students will practice the implementation of principles, and application of procedures as well as interpretation methods adapted to a selected case study, individually, understanding the approach of agriculture related environmental issues at scientific level, following the instructions of the lecturer. Students will work on either improving their BSc theses or planning their MSc research projects and write reports and articles for different target groups about the same scientific issue. The overall aim is to make it understandable what added value to the actual level of scientific knowledge means and how a research plan makes research successful.

**practices:**

1. Making difference between research and engineering; discovering rules in science; finding patents and understanding the link between science and business sector.
2. Formulating a scientific problem that has not been solved, yet, based on the articles available via the Science Direct data base, based on the student’s interest.
3. Formulating a hypothesis to justify a theory, and a relevant objective; justifying the approach.
4. Literature review and writing an Introduction chapter for an original research paper manuscript; creating the structure of a review.
5. Developing a research proposal with consideration of all necessary resources; clarifying expectations based on the actual level of scientific knowledge, creating conceptual model.
6. Describing and assessing a case study, working with data, transforming data into information, modelling and model validation.
7. Identifying relevant indicators of a phenomenon, relationships; formulating experimental designs; data collection, sampling from existing databases, measurements in the field and in the laboratory with environmental samples.
8. Finding and discussing changes, trends; applying relevant statistical methods; understanding correlation and regression.
9. Answering the scientific question, solving the problem, arriving at a conclusion that is an added value to the actual level of knowledge.
10. Analysing the structure of an abstract and writing one.
11. Finalizing the research paper manuscript.
12. Writing short article for the public based on the original research paper.
13. Preparing a 10 minutes long presentation for scientists.
14. Analysing reviewers’ assessment and opinions for given manuscripts submitted to a journal.

**Literature, handbooks**

Macrina, F. L. (2000): Scientific Integrity: An Introductory Text with Cases, 2nd ed. ASM Press, Washington, DC.ISBN-13: 9781555811525

Montgomery, S. L. (2003): The Chicago Guide to Communicating Science. University of Chicago Press, Chicago. ISBN-13: 978-0226534855

J. L. Lebrun (2008): Scientific writing. A readers and writer’s guide. Word Scientific Publishing. Singapore. 223.p. ISBN-13: 978-9814350600

M.J. Katz (2009): From research to Manuscript. A guide to scientific writing. Spinger Publ. 204. p.  ISBN-13: 978-1402094668

[Mertler, Craig A.](http://www.prospero.hu/katalogus/kereso/?form_submit=1&szerzo=Mertler+Craig) (2015): Introduction to Educational Research. Sage Publications. ISBN-13: 9781483375489

Exercise book: Practical exercises for the course of Environmental statistics, research methodology - scientific communication

**Soil physics and geohydrology, MTMKG8002A**

**Name and title of the person responsible for the subject:** Dr. Tamás Magyar, senior lecturer

**Additional instructors involved in teaching the subject:** Guizani Douraied, PhD student

**Name and level of the program:** Agricultural Water Management Engineering MSc

**Subject type:** compulsory

**Teaching timetable of the subject, type of examination:** 2+2 K

**Credit value of the subject:** 3

**Purpose of teaching the subject:** 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:

**Content of the subject (14 weeks):**

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. Soil compaction and soil structure deterioration
13. Soil physical aspects of amelioration, cultivation and irrigation.

**Type of mid-term examination:** -

**Method of assessment (semester examination mark - report, practical grade, colloquium, examination):** Colloquium

**Teaching aids:** Presentation materials.

**Recommended literature:**

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

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

**Waste management in agriculture and food industry, MTMKG8017A**

**Name and title of the person responsible for the subject:** Dr. Tamás Magyar, senior lecturer

**Additional instructors involved in teaching the subject: -**

**Name and level of the program:** Agricultural Environmental Management Engineering MSc

**Subject type:** compulsory

**Teaching timetable of the subject, type of examination:** 2+1 K

**Credit value of the subject:** 3

**Purpose of teaching the subject:** The aim of the subject is to provide the background of agricultural and food processing waste disposal and treatment. Proper waste management is an important part of food production as well as agricultural activity. The uncontrolled decomposition of waste from agroindustrial sources can result in large-scale contamination of the environmental elements such as land, water, and air. The negative effects of the generated wastes in the above-mentioned industries can be mitigated by up-to-date treatment methods.

**Content of the subject (14 weeks):**

1. Agricultural wastes and by-products
2. Classification and recycling of animal wastes and by-products
3. The impacts of climate change on agricultural and food industries
4. Complex personal task – Part 1
5. Complex personal task – Part 2
6. Food regulations
7. Food loss and waste
8. From food to waste
9. Causes of food waste generation
10. Effects of food waste on environment and economy
11. How can we act against food wastage?
12. Conscious shopping and food safety
13. Alternative solutions for food waste reduction

**Type of mid-term examination:** -

**Method of assessment (semester examination mark - report, practical grade, colloquium, examination):** Practical grade

**Teaching aids:** Presentation materials.

**Recommended literature:**

Conly L. Hansen, Dae Yeol Cheong (2019): Chapter 26 - Agricultural Waste Management in Food Processing. Myer Kutz (Eds): Handbook of Farm, Dairy and Food Machinery Engineering (Third Edition), Academic Press, pp. 673-716, ISBN 9780128148037, <https://doi.org/10.1016/B978-0-12-814803-7.00026-9>

Lawrence K. Wang, Mu-Hao Sung Wang, Yung-Tse Hung (Eds) (2022): Waste Treatment in the Biotechnology, Agricultural and Food Industries. Handbook of Environmental Engineering, Vol. 1, Springer Cham, pp. 1-485, ISBN: 978-3-031-03591-3. <https://doi.org/10.1007/978-3-031-03591-3>

USDA-NRCS (United States Department of Agriculture – Natural Resources Conservation Service): Agricultural Waste Management Field Handbook. <https://directives.sc.egov.usda.gov/OpenNonWebContent.aspx?content=31493.wba>

**Wastewater and slurry management, MTMVG8009A**

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 quality management MTMKGL8016A**

**Name and title of the person responsible for the subject:** Dr Csaba Pregun, assistant professor

**Additional instructors involved in teaching the subject: Dr. Nikolett Kiss**

**Name and level of the program:** Agricultural Water Management Engineering MSc

**Subject type:** compulsory

**Teaching timetable of the subject, type of examination:** 2+1 K

**Credit value of the subject: 3**6

**Purpose of teaching the subject:**

To learn about the characteristics that determine water quality, water pollutants, pollution processes and the mechanisms of self-purification. To learn water qualification and water quality protection techniques and practices. Learning about water pollutants, their effects, water protection management and technologies.

**Content of the subject (13 weeks):**

1. Water management - water resources management. Water balances, water resources, water uses in Hungary.
2. Hydrological basics. Types of surface water and groundwater.
3. Physical, organoleptic, chemical, biological, bacteriological characterisation of water. Principles of surface water classification, water quality classes.
4. Water quality assessment methods used in Hungary and in the EU.
5. Ecological water quality assessment
6. Water pollution, pollutants, their classification. Human activities causing water pollution.
7. Oil pollution and its effects.
8. Effect of pollutants on aquatic ecosystem species, flora, fauna.
9. Effects of pollutants on drinking water. Process of pollution of watercourses, spread of pollutants, self-purification of watercourses.
10. Pollution of stagnant waters, eutrophication, input, output methods to control eutrophication.
11. Groundwater pollution, sources, spread of pollution. Groundwater protection.
12. Mechanical and biological wastewater treatment. Domestic water quality management and protection.
13. Legal, economic, technical methods of water quality protection

**Type of mid-term examination:** Participation in the exercises is compulsory. In case of absence, the student is required to submit a theoretical and practical report on the missed practical training or to participate in the departmental research. Participation in the practicals is a prerequisite for obtaining a signature.

**Method of assessment (**semester examination mark - report, practical grade, **colloquium**, examination):colloquium

**Teaching aids:** Lecture slides and supplementary material are available in ppt and pdf format (E-learning).

**Recommended literature:**

* J. Jeffrey Peirce, P. Aarne Vesilind, Ruth F. Weiner (1997): Environmental Pollution and Control, 4th. Elsevier Science & Technology Books. ISBN: 0750698993
* Mackenzie L. Davis (2010): Water and Wastewater Engineering. Design Principles and Practice. McGraw-Hill. ISBN: 978-0-07-171385-6
* Federal Interagency Stream Restoration Working Group (FISRWG) (10/1998). Stream Corridor Restoration: Principles, Processes, and Practices. GPO Item No. 0120-A; SuDocs No. A 57.6/2:EN3/PT.653. ISBN-0-934213-59-3.
* M. R. Templeton, D. Butler: An Introduction to Wastewater Treatment. Ventus Publishing 2011. ISBN 978-87-7681-843-2

# **Internship**

Students have to carry out a 4-week internship involved in the model curriculum. The internship course must be signed up for previously via the NEPTUN study registration system in the fall semester (3rd semester). Its execution is the criteria requirement of getting the pre-degree certificate (absolutorium).

# **Work and Fire Safety Course**

According to the Rules and Regulations of University of Debrecen a student has to complete the online course for work and fire safety. Registration for the course and completion are necessary for graduation. For MSc students the course is only necessary only if BSc diploma has been awarded outside of the University of Debrecen.

Registration in the Neptun system by the subject: MUNKAVEDELEM

Students have to read an online material until the end to get the signature on Neptun for the completion of the course. The link of the online course is available on webpage of the Faculty.

# **Physical Education**

According to the Rules and Regulations of University of Debrecen a student has to complete Physical Education courses at least in two semesters during the Bachelor training and one semester during the Master training. Our University offers a wide range of facilities to complete them. Further information is available from the Sport Centre of the University, its website: [http://sportsci.unideb.hu.](http://sportsci.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 (referee). By solving the task, the agricultural environmental management engineering 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 Agricultural Environmental Management Engineering graduate 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 agricultural environmental management engineering program the credits assigned to the thesis is 30.

The latest that thesis topics are announced by the departments for the students is the end of Week 4 of the study period of the last semester. A thesis topic can be suggested by the student as well and the head of department assigned shall decides 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 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 Agricultural Environmental Management Engineering 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: Outstanding 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 Honour

An award with Honour 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.

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|  | *Coordinator: Dr. Péter Tamás Nagy, associate professor* |
|  |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   | **01. 09. 2023.** |  |
| **Code** | **Subject name** | **semester I** | **semester II** | **semester III** | **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*** |   |   |   |   |   |   |
| MTMKG8001A | Environmental chemistry | 2 | 2 | K | 4 |   |  |  |   |   |  |  |   |   |  |  |  | Dr. Nagy Péter Tamás |   |
| MTMKG8002A | Soil physics and geohydrology | 2 | 2 | G | 4 |   |  |  |   |   |  |  |   |   |  |  |  | Dr. Magyar Tamás |   |
| MTMKG8003A | Environmental informatics – Environmental monitoring | 2 | 2 | K | 4 |   |  |  |   |   |  |  |   |   |  |  |  | Dr. Tamás János |   |
| MTMKG8004A | Applied hydrology and hydraulics | 3 | 3 | K | 6 |   |   |   |   |   |   |   |   |   |   |   |   | Dr. Pregun Csaba |   |
| MTMKG8005A | Circular Economy in Agriculture | 2 | 1 | G | 3 |   |  |  |   |  |  |  |   |  |  |  |   | Dr. Szőllősi Nikolett |   |
| MTMKG8006A | Physical and chemical methods of environmental technology | 3 | 2 | G | 5 |   |  |  |   |   |  |  |   |   |  |  |  | Dr. Magyar Tamás |   |
|   | *Total number of hours:* | 14 | 12 |   | 26 |   |   |   |   |   |   |   |   |   |   |   |
| MTMKG8007A | Natural sciences II - Nature conservation ecology |  |  |  |  | 2 | 2 | G | 4 |   |  |  |   |   |  |  |   | Dr. Juhász Lajos |   |
| MTMKG8008A | Environmental impact assessment and environmental modeling |  |  |  |  | 2 | 2 | K | 4 |   |  |  |   |   |  |  |   | Dr. Tamás János |   |
| MTMKG8009A | Wastewater and slurry management |  |  |  |  | 2 | 1 | G | 3 |   |  |  |   |   |  |  |   | Dr. Boczonádi Imre |   |
| MTMKG8011A | Environmental technologies I.: Soil remediation, soil protection, biotechnology in agriculture |  |  |  |  | 2 | 1 | K | 3 |  |  |  |  |   |  |  |   | Dr. Nagy Attila |   |
| MTMKG8012A | Environmental Measurement Techniques |  |  |  |  | 2 | 2 | G | 5 |  |  |  |  |   |  |  |  | Dr. Nagy Péter Tamás |   |
| MTMKG8013A | Environmental Technologies II: Aerobic and anaerobic technological systems |  |  |  |  | 2 | 1 | K | 3 |   |  |  |   |   |  |  |   | Dr. Magyar Tamás |   |
| MTMKG8015A  | Agricultural forestry and biomass production |   |   |   |   | 2 | 1 | K | 3 |   |   |   |   |   |  |  |   | Dr. Rédei Károly |   |
|   | *Total number of hours:* |   |   |   | 14 | 10 |   | 25 |   |   |   |   |   |   |   |   |
| MTMKG8010A | Precision agriculture |  |  |  |  |   |   |   |   | 1 | 2 | G | 3 |   |  |  |   | Dr. Nagy Attila |   |
| MTMKG8014A  | Drought and excess water management, melioration |  |  |  |  |   |  |  |   | 3 | 2 | K | 3 |   |  |  |   | Dr. Nagy Attila |   |
| MTMKG8016A  | Water quality management |   |   |   |   |   |   |   |   | 2 | 1 | K | 3 |   |   |   |   | Dr. Pregun Csaba |   |
| MTMKG8017A  | Waste management in agriculture and food industry |  |   |   |   |   |   |   |   | 2 | 1 | G | 3 |   |  |  |  | Dr. Magyar Tamás |   |
| MTMKG8018A  | Environmental planning, land consolidation, landscape conservation |   |   |   |   |   |   |   |   | 2 | 1 | K | 3 |  |  |  |  | Dr. Fehér Zsolt |   |
| MTMKG8019A  | Farm Business Management and Project Management |  |   |   |  |   |   |   |   | 1 | 2 | G | 3 |   |   |   |   | Dr. Szőllősi Nikolett |   |
|   | *Total number of hours:* |   |   |   |   |   |   | 11 | 9 |   | 18 |   |   |   |   |   |
| MTMKG8020A  | Agro-environmental management: Ecotoxicology, environmental risk assessment |  |  |  |   |   |  |  |   |   |  |  |   | 2 | 2 | G | 4 | Dr. Nagy Péter Tamás |   |
| MTMKG8021A  | Environmental Policy, Law and Sectoral administration |  |  |  |   |   |  |  |   |   |  |  |   | 2 | 1 | K | 3 | Dr. Szőllősi Nikolett |   |
| MTMKG8022A  | Agricultural biotechnology |   |   |   |   |   |   |   |   |  |  |  |   | 2 | 1 | G | 3 | Dr. Boczonádi Imre |   |
|   | *Total number of hours:* |   |   |   |   |   |   |   |   |   | 6 | 4 |   | 10 |   |   |
|   | ***Optional subjects*** |   |   |   |   |   |   |
| MTMKG8023A  | Remote sensing |  |  |  |  |   |  |  |   | 0 | 3 | G | 3 |  |  |  |   | Dr. Nagy Attila |   |
| MTMKG8024A  | Research methodology, scientific communication |  |  |  |  |   |  |  |   | 0 | 3 | G | 3 |  |  |  |   | Dr. Nagy Péter Tamás |   |
| MTMKG8025A  | Air quality protection | 0 | 3 | G | 3 |   |  |  |   |   |  |  |   |  |  |  |  | Dr. Magyar Tamás |   |
| MTMKG8026A  | Noise and vibration protection |  |  |  |  |   |  |  |   | 0 | 3 | G | 3 |   |  |  |  | Dr. Magyar Tamás |   |
| MTM7NY1A  | Akadémiai nyelvi készségek (tudományos nyelv) | 0 | 2 | G | 3 |   |  |  |   |  |  |  |   |  |  |  |   | Dr. Czellér Mária |   |
| MTM7NY2A  | Professzionális nyelvi készségek (üzleti nyelv) |   |   |   |  |   |  |  |   | 0 | 2 | G | 3 |  |  |  |   | Dr. Czellér Mária |   |
| MTMKG8GYA | *Internship (4 weeks)* |   |   |   |   | 0 | 160 | G | 5 |   |   |   |   |   |   |   |   | Dr. Nagy Péter Tamás |   |
| MTMKG8D1A | *Thesis preparation I* |  |  |  |   |   |   |   |   | 0 | 3 | G | 10 |   |  |  |  | Dr. Tamás János |   |
| MTMKG8D2A | *Thesis preparation II* |   |   |   |   |   |   |   |   |   |   |   |   | 0 | 3 | G | 20 | Dr. Nagy Péter Tamás |   |
| SI-003 | *Physical excercise* | 0 | 2 | A | 0 |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
|   | *Total number of credits for compulsory subjects* | 26 | 25 | 18 | 10 | **79** |   |
|   | *Total number of credits for subjects of free choise* | 3 |   | 3 |   | **6** |   |
|   | *Professional practice (4 weeks)* |   | 5 |   |   | **5** |   |
|   | *Thesis* |   |   | 10 | 20 | **30** |   |
|   | Total credits: | 26/29 | 27 | 18/31 | 30 | **120** |   |
|   | Total number of hours alltogether (hour/week): | 14 | 12/17 | 26/31 | 14 | 10 |   | 11 | 9/18 | 21/29 | 6 | 4/7 | 10/13 |   |   |

**MODEL CURRICULUM OF AGRICULTURAL ENVIRONMENTAL 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-environmental-management-engineering**](https://mek.unideb.hu/en/agricultural-environmental-management-engineering) **).**