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

Crop Production Engineering MSc Program

2022

TABLE OF CONTENTS

[DEAN’S WELCOME 3](#_bookmark0)

[HISTORY OF THE UNIVERSITY 4](#_bookmark1)

HISTORY OF THE FACULTY…………………………………………………………………………………..6

[ADMINISTRATION UNITS FOR INTERNATIONAL PROGRAMMES](#_bookmark2) 7

[DEPARTMENTS OF THE FACULTY](#_bookmark3)………………………..……………………………………………..10

[ACADEMIC CALENDAR 23](#_bookmark4)

[Information about the Program 2](#_bookmark6)3

[Course Descriptions](#_bookmark8) 24

[Internship](#_bookmark10) 64

[Thesis](#_bookmark14) 64

[Final examination (Final Exam)](#_bookmark15) 65

Diploma……………………………………………………………………………………………………67

Curriculum………………………………………………………………………………………………..68

**DEAN’S WELCOME**

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

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

Dr. László Stündl

associate professor

dean

**HISTORY OF THE UNIVERSITY**

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

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

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

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

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

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

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

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

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

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

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

**HISTORY OF THE FACULTY**

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

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

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

# **ADMINISTRATION UNITS FOR INTERNATIONAL PROGRAMMES**

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

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

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

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

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)

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# **INSTITUTE OF HORTICULTURE**

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

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# [**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**

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| Dr. Csaba Juhász  Associate Professor | [juhasz@agr.unideb.hu](mailto:juhasz@agr.unideb.hu)  room 4, building E |
| Dr Kovács Elza,  Associate Professor | [ekovacs@agr.unideb.hu](mailto:ekovacs@agr.unideb.hu)  room 1, building E |
| Dr Marton L. Csaba, PhD  Professor | [marton.csaba@atk.hu](mailto:marton.csaba@atk.hu)  room 11, building E |
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**INSTITUTE OF NUTRITION**

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

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| Dr Péter Sipos  Professor | [siposp@agr.unideb.hu](mailto:siposp@agr.unideb.hu)  room V8, building D |
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# **INSTITUTE OF PLANT PROTECTION**

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**AGRICULTURAL LABORATORY CENTRE**

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| Dr Szilvia Kovács  Assistant Research Fellow | [kovacs.szilvia@agr.unideb.hu](mailto:kovacs.szilvia@agr.unideb.hu)  basement, building K-L |

**INSTITUTE OF WATER AND ENVIRONMENTAL MANAGEMENT**

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|  |  |
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**ACADEMIC CALENDAR**

# General structure of the academic year:

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

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

The academic calendar for the given semester can be found on the faculty's website:

https://mek.unideb.hu/en

# **THE CROP PRODUCTION ENGINEERING GRADUATE PROGRAM**

INTRODUCTION OF THE PROGRAM

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

In the Crop Production Engineering master course, students learn the basic concepts of natural science, engineering, technology, food chain safety and management that underpin plant production, and become familiar with modern technologies used in crop production and their practical application. The training will focus on plant biotechnology, integrated crop production, integrated pest management, quality assurance in crop production and the sectoral economics of crop production.

Main subjects typically include (this list is indicative and subject to change):

Physiology of cultivated plants, Organic and biochemitry, Applied Soil Science, Agricultural informatics, Agricultural microbiology, Genetics of cultivated plant, Adaptive Tillage, Crop production I., Crop Production II., Plant biotechnology, Diseases of cropland plants, Animal pests of crops, Weed control, Crop production economics, Introduction to EU Law, Precision farming, Agrochemistry, Plant breeding and transgenic plants, Land classification and regional development, Quality control of field crops, Quality assurance in field crops, Mechanization of crop production, Nutrient supply of field crops, Irrigated crop production, Research methodology and extension

Internship, practice: Students should complete a 4-week professional practice.

Graduates may find employment in agricultural enterprises, in product development, in trade of agricultural goods, in crop production extension companies, in professional administration, or in scientific research..

**COURSE DESCRIPTIONS FOR CROP PRODUCTION ENGINEERING MSC**

The order of subjects in alphabetical order.

|  |
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| [Academic Language Skills (Academic Language)](https://mek.unideb.hu/sites/default/files/upload_documents/academic_language_skills_i.docx)**MTM7NY1A** |
| [Adaptive Tillage](https://mek.unideb.hu/sites/default/files/upload_documents/adaptive_tillage.docx)**MTMNT7007** |
| [Agricultural informatics](https://mek.unideb.hu/sites/default/files/upload_documents/agricultural_informatics.docx)**MTMNT7004** |
| [Agricultural microbiology](https://mek.unideb.hu/sites/default/files/upload_documents/agricultural_microbiology.docx)**MTMNT7005** |
| [Agrochemistry](https://mek.unideb.hu/sites/default/files/upload_documents/agrochemistry.docx) |
| [Agroecological systems](https://mek.unideb.hu/sites/default/files/upload_documents/agroecological_systems.docx)**MTMNT7043** |
| [Animal pests of crops](https://mek.unideb.hu/sites/default/files/upload_documents/animal_pests_of_crops.docx)**MTMNT7012** |
| [Basics of Integrated Plant protection](https://mek.unideb.hu/sites/default/files/upload_documents/basics_of_integrated_plant_protection.docx)**MTMNT7044** |
| [Biological bases, variety use](https://mek.unideb.hu/sites/default/files/upload_documents/biological_bases_variety_use.docx)**MTMNT7033** |
| [Communication](https://mek.unideb.hu/sites/default/files/upload_documents/communication.docx)**MTMNT7028** |
| [Crop production economics](https://mek.unideb.hu/sites/default/files/upload_documents/crop_production_economics.docx)**MTMNT7014** |
| [Crop production I.](https://mek.unideb.hu/sites/default/files/upload_documents/crop_production_i.docx)**MTMNT7008** |
| [Crop production II](https://mek.unideb.hu/sites/default/files/upload_documents/crop_production_ii.docx)**MTMNT7009** |
| [Crop production in EU](https://mek.unideb.hu/sites/default/files/upload_documents/crop_production_in_eu.docx)**MTMNT7041** |
| [Cultivation of medicinal plants](https://mek.unideb.hu/sites/default/files/upload_documents/cultivation_of_medicinal_plants.docx)**MTMNT7031** |
| [Diseases of cropland plants](https://mek.unideb.hu/sites/default/files/upload_documents/diseases_of_cropland_plants.docx)**MTMNT7011** |
| [Energy plant cultivation](https://mek.unideb.hu/sites/default/files/upload_documents/energy_plant_cultivation.docx)**MTMNT7032** |
| [Food chain safety](https://mek.unideb.hu/sites/default/files/upload_documents/food_chain_safety.docx)**MTMNT7038** |
| [Fundamentals of eco-physiology for more efficient plant production](https://mek.unideb.hu/sites/default/files/upload_documents/fundamentals_of_eco-physiology_for_more_efficient_plant_production.docx)**MTMNT7045** |
| [Genetics of cultivated plant](https://mek.unideb.hu/sites/default/files/upload_documents/genetics_of_cultivated_plant.docx)**MTMNT7006** |
| [Grassland management](https://mek.unideb.hu/sites/default/files/upload_documents/grassland_management.docx)**MTMNT7026** |
| [Internship](https://mek.unideb.hu/sites/default/files/upload_documents/internship_0.docx) |
| [Introduction to EU Law](https://mek.unideb.hu/sites/default/files/upload_documents/introduction_to_eu_law.docx)**MTMNT7015** |
| [Irrigated crop production](https://mek.unideb.hu/sites/default/files/upload_documents/irrigated_crop_production.docx)**MTMNT7024** |
| [Land classification and regional development](https://mek.unideb.hu/sites/default/files/upload_documents/land_classification_and_regional_development.docx)**MTMNT7019** |
| [Mechanization of crop production](https://mek.unideb.hu/sites/default/files/upload_documents/mechanization_of_crop_production.docx)**MTMNT7022** |
| [Nutrient supply of field crops](https://mek.unideb.hu/sites/default/files/upload_documents/nutrient_supply_of_field_crops.docx)**MTMNT7023** |
| [Operation of agricultural machinery](https://mek.unideb.hu/sites/default/files/upload_documents/operation_of_agricultural_machinery.docx)**MTMNT7035** |
| [Organic and Biochemistry](https://mek.unideb.hu/sites/default/files/upload_documents/organic_and_biochemistry.docx)**MTMNT7002** |
| [Organic crop production](https://mek.unideb.hu/sites/default/files/upload_documents/organic_crop_production.docx)**MTMNT7029** |

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| Name of course:Physiology of cultivated plants | **Credit value: 3** |
| **Course** **classification**: obligatory | |
| **The proportion of the practical nature of the course, „educational character”: 50%** | |
| **Type of course:** theoretical / practical, and the **total number: hours** in the given **semester.**  Further (unique) means and properties of knowledge transfer: 28 lectures + 28 practices / semester | |
| **Exam** type (colloquium / practical grade / **other** ): colloquium  Further (unique) means of knowledge verification**:** | |
| The curricular **place of the course** (which semester): 1st semester | |
| Prerequisites (if any): **-** | |

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| **Course description: a brief, but informative description of the knowledge to be acquired (14 weeks).** |
| In plant physiology lectures, the knowledge material is the life phenomena and life processes of plants. Students get acquainted with the plant biological evaluation of structure-function. Through the experiments performed in the practices, students gain insight into the design and methodology of plant physiology experiments and investigation methods. Experiments help to understand and master the theoretical material. Students will be competent in the knowledge of plant life to improve the effectiveness of applied crop production.   |  |  | | --- | --- | | 1 | Basics in plant physiology, structure and funtion | | 2 | Leaves, light absorption in photosyntheis | | 3 | Carbon acquisition and fixation | | 4 | Respiration (photo-, and dark) | | 5 | Plant water relations: stomata, transpiration and plants in water-limited environments | | 6 | Functions of nutrients in plant I. | | 7 | Functions of nutrients in plant II. | | 8. | Symbiotic relationships for nutrient capture, Nitrogen assimilation | | 9. | Plant hormones – regulation of development and Plant hormones – environmental acclimation I. | | 10. | Plant hormones – regulation of development and Plant hormones – environmental acclimation II. | | 11. | Flowering | | 12. | Fruit and seeds | | 13. | Seed germination/dormancy | | 14. | Senescence | |
| **Required and recommended reading:** |
| **Required reading:**  Lévai, L. Veres, Sz. (2013) Applied Plant Physiology. Digitális Tankönyvtár (https://regi.tankonyvtar.hu/hu/tartalom/tamop412A/2011\_0009\_Levai\_Laszlo\_Veres\_Szilvia-Applied\_Plant\_Physiology/index.html)  Taiz, L., Zeiger, E. (2007) Plant Physiology. 4th ed. Sinauer Associates, Inc. ISBN 0-87893-823-0 or online version  **Recommended reading:**  Buchanan, B. B., Gruissem, W., Jones, R. L. (2015) Biochemistry and Molecular Biology of Plants. John Wiley & Sons, Inc. ISBN: 978-0-470-71421-8  Lambers, H., Chapin, F. S. and Pons, T. L. (2011) Plant Physiological Ecology. Springer, New York. ISBN 0-387-98326-0 |
| **Competencies to be acquired, related to the course:** |
| **a) Knowledge:**   * fundamental knowledge about several basic theories in plant physiology * interaction between physiological processes * how can the farmer modify, influence these processes   **b) Ability:**   * critical thinking * decision making   **c) Attitude:**   * to be motivated to work hard   **d) Autonomy and responsibility:**   * autonomy and responsibility in data discussion/presetation/evaluation |

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| **Course leader** (name, post, academic degree): **Dr. Veres Szilvia, professor, PhD** |
| **Other lecturer(s) involved in teaching the course, if any** (name, post, academic degree): **-** |

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| **Name of the Course**: Organic and Biochemistry | **Credit value: 3** |
| **Course classification**: compulsory | |
| **The proportion of the theoretical/practical nature of the course, „educational character”:** 50/50% (credit%) | |
| **Type of the course,** and number of lessons: 28 hours of lectures and 28 hours of practice in the given semester  Additional ways and characteristics to be used in the transfer of the given knowledge: - | |
| **Exam type**: written exam  Additional methods to be used in the knowledge test: written tests, assignments | |
| **Curriculum location of the course (which semesters**): 1st semester | |
| Prerequisites: - | |

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| Course description: a brief, yet informative description of the knowledge to be acquired (14 weeks). |
| The general aim of the course are :  to introduce the organic compounds present in plants, discussing their biological function, describing their formation and degradation in the intermediate metabolism.   1. week: Functional groups, intermolecular forces and physical properties of organic compounds 2. week: A brief characterization of alkanes, alkenes, dienes, polyenes (terpenes), alcohols and aliphatic oxo compounds. (Physical-chemical properties. Their most important representatives.) 3. week: Physical and chemical properties of carboxylic acids, their derivatives ( esters ) week:. 4. week: Carbohydrates. Properties of mono-, di and polysaccharides. Relationship between structure and biological function. 5. week. Amino acids, dipeptides, polypeptides. Structure and grouping of proteins. Biological functions of proteins. Protein classification. Structure of cell membranes. 6. week. Lipids (Classification, structure, biological function.) 7. week: week: Aromatic compounds: benzene, phenols and quinones. Heterocyclic compounds. Pyridine, pyrimidine, purine, pyrrole, Indole backbone, indole backbone compounds. Porphine backbone compounds and their biological functions. 8. week: Structure of nucleotides. Structure of NAD +, NADP +, FAD, ATP, their biological role. Primary structure and secondary structure of nucleic acids. Biological function of nucleic acids. 9. Week . Protein synthesis. Hydrolysis of proteins 10. week: The enzymes. Classification of enzymes. Regulation of enzyme function. Common features of vitamins and their mechanism of action. Plant hormones. 11. week: Photosynthesis. The light and dark phase of photosynthesis. Synthesis of sucrose and starch. C3 - C4 - plants. 12. week: Degradation of carbohydrates. Reaction sequence and energy balance of glycolysis, citric acid cycle and terminal oxidation. Direct oxidation of glucose (pentose phosphate cycle). Glucose resynthesis. 13. week: Fermentation processes. 14. week: Fat metabolism. Biosynthesis of fatty acids. Decomposition and energy balance of saturated, unsaturated, even and odd carbon fatty acids. |
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| Practise:   1. week: Practise to write structural formula and bond line drawing, 2. week: Test + The study the physical properties and alkalinity of organic chemicals 3. week: Separation of leaf pigments with thin layer chromatography 4. week: Test + Making solutions, acid-base titration 5. week: Determination of C-vitamin content (iodometric titration) 6. week: Test + Test tube experiments with carbohydrates 7. week: Experiments with amino acids and proteins 8. week: Test + Total nitrogen determination (Kjeldahl method) 9. week: Qualification of fats and oils 10. week : Test + The study of enzyme activity versus substrate concentration. 11. Week: The study the enzyme activity of amylase enzyme vs temperature 12. week: Test +The study of UV-Vis spectrometry method , analysis of salicylic acid measurement data 13. week: Investigation of the function of protein degrading enzymes. 14. week: Test + Refractometer , hydrometer (determination of sugar and alcohol content) 15. week: Final test |
| **Required and recommended reading:** |
| Required reading:  Frederick A. Bettelheim, Mary K. Campbell, Shawn O. Farrell, William H. Brow (2014) Introduction to General, Organic and Biochemistry ISBN-13-9780495110699  Recommended reading:  Cox, M. M., & Nelson, D. L. (2008). Lehninger principles of biochemistry (Vol. 5). New York: Wh Freeman.  David R, Klein Organic chemistry as a second language 2004, John Wiley and Sons Inc, ISBN 0-471-27235-3 |
| **Competencies to be acquired, related to the course:** |
| 1. **knowledge**   - Knowledge of organic compounds found in plant organisms, their properties, biological functions and processes in cells.  -Knowledge of the quality indicators of the food raw materials (for proteins, lipids, carbohydrates).   1. **abilities**   - The student will be able to successfully acquire knowledge of other subjects (physiology, plant nutrition, etc.).  - The student recognizes the unity of the natural sciences, thus increasing the problem-solving skills.   1. **attitude**   - By acquiring the knowledge of the subject, the student develops a scientific way of thinking and approach.  - His professional interest becomes deepened.   1. **autonomy and responsibility**   - The student will be able to make an independent decision because of the confident, accurate and thorough knowledge. |

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| **Course leader** (name, position, degree): Erdeiné Dr. Kremper Rita Assistant Professor, PhD. |
| **Other lecturer(s) involved in teaching the course, if any** (name, position, degree): - |

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| **Applied Soil Science:** | **Credit value: 3** |
| **Course** **classification**: compulsory | |
| **The proportion of the practical nature of the course, „educational character”: 50-50%** | |
| **Type of course: 14** theoretical / 14 practical, and the **total number: 28 hours** in the given **semester.**  Further (unique) means and properties of knowledge transfer: making lesson presentations and homework papers, classroom test. | |
| **Exam** type (colloquium / practical grade / **other** ):  **colloquium**  Further (unique) means of knowledge verification**:** Learning the curriculum allows students to supplement their knowledge and utilize it in a creative way during their later work.. | |
| The curricular **place of the course** (which semester): 1th semester | |
| Prerequisites (if any): **-** | |

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| **Course description: a brief, but informative description of the knowledge to be acquired (14 weeks).** |
| 1) Soil is the part of the biosphere. The concept of soil, its constituents. The abiotic and biotic subsystem in the soil. The soil profile. Ecological functions of soil.  Soil profile, soil sampling  2) The importance of minerals and rocks in soil formation. The weathering. The formation of the soils.  Soil texture. Clay and silt content. Plasticty.  3) The most important physical properties of soils  Bulk density and soil density, porosity  4) The soil formation, morphological and agronomic evaluation of the soil structure. Soil water management.  Determination of soil structure.  5) The most important soil chemical properties. Organic matters in the soil.  Measurement of soil organic matter content.  6) Colloids. Processes on the surface of colloids. Effect of adsorbed cations on soil properties.  Measurement of soil cation exchange properties.  7) The pH of the soil. The acitive and potential acidity of soils. The buffer capacity of soil.  Measurment of soil pH and buffer capavity.  8) Soil defects that reduce soil fertility.  Measurement of sodium- and calcium carbonate content of soils.  9) Soil development. Grouping of soil properties based on their temporal variability.  Testing of waters used for soil irrigation  10) Soil aspects of fertilizer use  Soil incubation experiment I.  11) Impact of human activity on the soil  Soil incubation experiment II.  12) Effects natural ecological factors in soil  Calculation of soil moisture content  13) The genetic classification of soil.  Calculation of the amount of hydrogen ions in the soil.  14) The effect of irrigation on the soil  Classroom test |
| **Required and recommended reading:** |
| **Required reading:**  Brady, N. C. (1990) The Nature and Properties of Soils. Collier Macmillan Publishers (London). 10th ed.  J. Benton Jones Jr. (2001) Laboratory guide for Conducting soil tests and plant analysis, , ISBN: 0849302064, CRC Press LLC  **Recommended reading:**  Eash, N. S. – Green C. J. Razvi, A. – Bennett, W. F. (2008) Soil Science Simplified. (fifth ed.) Blackwell Publishing |
| **Competencies to be acquired, related to the course:** |
| **a) Knowledge:**  Obtain knowledge about the most important properties of soil in field and laboratory tests.  To know the basic concepts of practice.  Recognize the simple relationships between soil properties in the knowledge of basic concepts.  **b) Ability**  Be able to take the soil sample professionally in accordance with the objectives.  According to the specified protocol, it can perform a simple basic test.  Be able to receive new knowledge. Be able to build on previous knowledge.  **c) Attitude:**  To evaluate the soils based on the test results obtained.  Be able to connect to simple research tasks  **d) Autonomy and responsibility:**  Be able to make a responsible suggestion to improve your soil properties.  To be able to find solutions to the arised new soil problems or in the special literature or researcher laboratories |

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| **Course leader** (name, post, academic degree): **Dr. Mária Csubák, ,** **associate professor, CSc** |
| **Other lecturer(s) involved in teaching the course, if any** (name, post, academic degree): **-** |

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| Name of course: **Agricultural informatics** | **Credit value: 3** |
| **Course** **classification**: **compulsory** | |
| **The proportion of the practical nature of the course, „educational character”: practical** | |
| **Type of course: 15** theoretical / 30 practical, and the **total number: The 45 hours** in the given **semester.**  Further (unique) means and properties of knowledge transfer: ---- | |
| **Exam** type (colloquium / practical grade / **other** ):  **practical**  Further (unique) means of knowledge verification**: -----** | |
| The curricular **place of the course** (which semester): **1. semester** | |
| Prerequisites (if any): **-** | |

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| **Course description: a brief, but informative description of the knowledge to be acquired (14 weeks).** |
| *Brief description:* During the training, students should acquire the IT and computer skills necessary to acquire the competences of the training programme. Be familiar with the basic theoretical concepts of database management, data models and modelling techniques. Acquire knowledge of Internet applications, GIS, spreadsheet and statistical modelling systems and information systems.  *Contents of the subjects in 14 weeks:*   1. Computer networks and Internet services. 2. Spreadsheet and modelling systems I. 3. Spreadsheet and modelling systems II. 4. Basic of Geographic Information Systems 5. Types of Geographic Information Systems 6. Areas of application and application possibilities 7. Practical exam I. (Excel and GIS) 8. Basic concepts and objects of database management 9. Relational databases required for building objects and their uses 10. Preparation of professional queries 11. Preparation of professional reports 12. Professional information systems 13. Conversion of data exported from professional information systems to Office programmes 14. Practical exam II. (databases) |
| **Required and recommended reading:** |
| **Required reading:**   * Department teaching materials: Business informatics, electronic booklet 2017. * Excel Functions, http://www.excelfunctions.net * Access 2013 training courses, https://support.office.com/en-IN/ article/-a4bd10ea-d5f4-40c5-8b37-d254561f8bce * MS Excel Topics, Tech on the Net, http://www.techonthenet.com/excel/index.php. * The Basics of GIS - Geographic Information Systems/Science - Research Guides at Dartmouth College   **Recommended reading:**   * R. Elmasri: Fundamentals of Database Systems, Pearson, 2016, ISBN: 9781292097619, pp. 1272 * Ullman, J.D., Widom J.: Adatbázisrendszerek, Alapvetés, Panem Kft., 2009, 9789635454815, pp. 600. * Date, J. C.: An Introduction to Database Systems, Pearson, 2003, ISBN13 (EAN): 9780321197849, pp. 1024. |
| **Competencies to be acquired, related to the course:** |
| **a) Knowledge:**  - It possesses the most basic information gathering, analysis, task, and problem solving methods.  - They have competencies needed to plan, organize and carry out the different processes of an agricultural enterprise and to participate actively in preparing decisions and in operative tasks  - They know the information and office technologies supporting agricultural processes.  - They know the rules and ethical standards of participating and cooperating in project, team and the different forms of agricultural organizations.  **b) Ability:**  - It makes simpler professional reports, evaluations, databases, and performs.  - Capable of making simple and agricultural cost calculations.  - Capable of cooperating effectively with colleagues and leaders in solving project and work tasks.  **c) Attitude:**  - It is receptive to receiving new information, professional knowledge and methodologies.  - They accept criticism and support of leaders and colleagues.  - They develop constantly his/her language competency, communication skill and keep up with the development of new communication technologies.  **d) Autonomy and responsibility:**  - Take responsibility for his/her own work and decisions.  - It performs job assignment independently, prepares own professional reports, create small queries and reports independently. If needed, it will be required to work with a staff member or a manager. |

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| **Course leader** (name, post, academic degree): **Dr. László Várallyai** |
| **Other lecturer(s) involved in teaching the course, if any** (name, post, academic degree): **-** |

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| Name of course: **Agricultural microbiology** | **Credit value: 3** |
| **Course** **classification**: **compulsory** | |
| **The proportion of the practical nature of the course, „educational character”:** 50 % | |
| **Type of course:** theoretical / practical, and the **total number: 28 hours** in the given **semester.**  Further (unique) means and properties of knowledge transfer: | |
| **Exam** type (colloquium / practical grade / **other** ): colloquium  Further (unique) means of knowledge verification**:** Overview and discussion of scientific publications | |
| The curricular **place of the course** (which semester): 1st | |
| Prerequisites (if any): **-** | |

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| **Course description: a brief, but informative description of the knowledge to be acquired (14 weeks).** |
| The aim of the subject is to provide appropriate basic knowledge for other courses (e.g. plant protection). The latest topics with agricultural and environmental interests will be discussed based on recent scientific publications. It will be introduced the role and significance of the most important microbiological processes in crop production. Basic skills and methods in a microbiological laboratory will be practiced in the laboratory.   1. Introduction and major terms of microbiology, cell chemistry 2. Microbial metabolism 3. Basic microbial genetics. 4. Microbial evolution and systematics 5. Structure of prokaryotic cells. Diversity of Bacteria and Archea 6. Organelles and phylogeny of microbial eukaryotes. Protists 7. Fungal physiology, structure and symbiosis 8. Fungal systematics and important fungal taxons 9. Metabolic diversity of microorganisms. 10. Carbon cycle, and the role of microbes in the N2 fixation, ammonification and nitrification. 11. Nitrogen cycle, and the role of microbes in the cellulose and lignin degradation. 12. The role and importance of microbes in the phosphorus and sulfur cycle. Bioremediation. 13. The role and importance of microbiological processes in the crop production. The characteristics of the plant microbiome. 14. Microbes as plant fertilizers, biostimulants and biocontrol agents. |
| **Required and recommended reading:** |
| **Required reading:**  Madigan, M. T, Martinko, J. M., Bender K., Buckley, D., Stahl, D (2015): Brock Biology of Microorganisms, Benjamin Cumming, 14th edition 1030 oldal, ISBN 978-1-292-01831-7  Jay, J. M., Loessner, M. J., Golden, D. A. (2005): Modern Food Microbiology. ISBN 978-0-387-23413-7  Adams, M. R., Moss M. O. (2008): Food Microbiology. The Royal Society of Chemistry. ISBN 978-0-85404-284-5  **Recommended reading:**  Karaffa E., Peles F (2014): Microbiological Aspects of Food Quality And Safety. Debreceni Egyetem, Debrecen.  Relevant scientific reviews and articles |
| **Competencies to be acquired, related to the course:** |
| **a) Knowledge:**  - Acquired basic knowledge of sciences, technologies, food-chain security giving the basis for agricultural microbiology.  - Acquired knowledge to up-to date technologies used in agricultural microbiology and the practical application  **b) Ability:**  - Ability in recognizing and solving the routine like problems occurring in the agricultural microbiology.  - Students can understand and observe the law, protocols and regulations connecting to agricultural microbiology  **c) Attitude:**  - Main feature is the constructive approach to the professional questions of microbiology.  - Students look for ways to change work methods to improve performance in agricultural microbiology.  - Health of the individual and society beside of environmental protection plays an important part in the professional decisions  **d) Autonomy and responsibility:**  - Students are able to bear the responsibility of the decisions and responsible for own and the attached workforce’s work  - Students are decisive at the right time  - Based on the professional knowledge students can set up the implementation plan of R&D projects independently, and bear the responsibility of direct managing of the development activity |

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| **Course leader** (name, post, academic degree): **Dr. Erzsébet Mónika Karaffa professor, PhD** |
| **Other lecturer(s) involved in teaching the course, if any** (name, post, academic degree): **Dr. Károly Pál senior research fellow, PhD** |

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| Name of course: **Genetics of cultivated plant** | **Credit value:** |
| **Course** **classification**: compulsory | |
| **The proportion of the practical nature of the course, „educational character”: 50/50 (%)** | |
| **Type of course: 1** theoretical / 1 practical, and the **total number: 3 hours** in the given **semester.**  Further (unique) means and properties of knowledge transfer: | |
| **Exam** type (colloquium / practical grade / **other** ):  **colloquium**  Further (unique) means of knowledge verification**:** | |
| The curricular **place of the course** (which semester): I. semester | |
| Prerequisites (if any): **-** | |

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| **Course description: a brief, but informative description of the knowledge to be acquired (14 weeks).** |
| Course objectives:  1. History of plant breeding  2. Basic of molecular genetics (definitions, basic of gene expression).  3. Basic of plant biotechnology, plant reproductive biology  3. Cytology of domesticated plants, the (poli)ploidy and its importance in the plant domestication  4. In vitro haploid techniques, and their significance in plant breeding  5. In vitro micropropagation techniques of cultivated plants, their importance of plant breeding  6. Traditional plant breeding techniques, seed biology  7. Mendel’s genetics, and its importance in modern plant breeding.  8. Inheritance of quantitative traits  9. Polimerase chain reaction, gel electrophoresis and its use in marker assisted plant breeding  10. Gene expression assays, RT-PCR, (RNA isolation and RNA integrity, one and two steps real time PCR)  11. Basic of bioinformatics and new generation sequencing (databases, primer designing, some free software usage).  12. GM plants  13. New generation gene editing techniques  14. Summary, test. |
| **Summary of content - practice**: The knowledge to be acquired is concise, as well as a 14 week breakdown of practice. |
| Description of goal:  Training of plant genetic and breeding, who are in possession of an appropriate economic approach, they know the cultivation of plants, knows the variety and its importance.  Skills to be learnt:   1. Plant biotechnology laboratory presentation, 2. Plant DNA/RNA isolation, the chemistry of ribonuleic acids. 3. IN vitro plant propagation: shoot induction, 4. In vitro plant propagation: in vitro seed showing 5. In vitro androgenesis on peper 6. In vitro somatic embryogenesis 7. Field practice (*Capsicum* crossing) 8. Bioassay of plant virus resistance, and their inheritance 9. Gel elektrophoresis- isolated DNA quality assays. 10. Gel elektrophoresis- isolated RNA quality assays. 11. PCR- RAPD, ISSR 12. RT-PCR 13. Molecular genetic data interpretation 14. Summary, test. |
| **Required and recommended reading:** |
| **Required reading:**  Acquaah, G. (2009). *Principles of plant genetics and breeding*. John Wiley & Sons., 584, <http://eprints.stiperdharmawacana.ac.id/105/1/%5BGeorge_Acquaah%5D_Principles_of_Plant_Genetics_and_%28BookFi%29.pdf>  **Recommended reading:**  Al-Khayri, J. M., Jain, S. M., & Johnson, D. V. (Eds.). (2015). *Advances in plant breeding strategies: breeding, biotechnology and molecular tools*. Springer International Publishing, ISBN: 978-3-319-22521-0. |
| **Competencies to be acquired, related to the course:** |
| 1. **Knowledge:**  * Knows, integrates, synthesizes and plant genetics, biotechnology development also places the disciplinary knowledge of plant breeding in systems * Knows the mechanism of action of the genes that can be used, work and food hygiene and as well as occupational safety regulations. * Knows plant breeding strategies.  1. **Skills:**  * They will be able of integrated plant variety management against that pose a threat to plants planning and implementation. * They will be able to perform practical plant cultivation, administrative and other plant breeding management tasks.  1. **Attitude:**  * Has the necessary knowledge to perform engineering and managerial duties. * Susceptible and suitable for cooperation. * Their work is characterized by high standard. * They are able to stand up for their views, but are open to others’ opinions as well.  1. **Autonomy and responsibility:**  * They can recognize the risks and boundaries of their decisions. * They have an independent sense of professional responsibility. * They are fully aware that in a foreign environment they always represent their country, thus influencing the picture of it by their behaviour. |

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| **Course leader** (name, post, academic degree): **Dr. Erika Kurucz, assistant professor, PhD** |
| **Other lecturer(s) involved in teaching the course, if any** (name, post, academic degree): **Dr. Antal Gabriella, assistant professor, PhD.** |

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| Name of course: **Adaptive Tillage** | **Credit value: 3** |
| **Course** **classification**: compulsory | |
| **The proportion of the practical nature of the course, „educational character”:** 67/33 (credit%) | |
| **Type of course: 2** theoretical / 1 practical, and the **total number: 42 hours** in the given **semester.**  Further (unique) means and properties of knowledge transfer: | |
| **Exam** type (colloquium / practical grade / **other** ): colloquium  Further (unique) means of knowledge verification**:** | |
| The curricular **place of the course** (which semester): 2 | |
| Prerequisites (if any): **-** | |

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| **Course description: a brief, but informative description of the knowledge to be acquired (14 weeks). (9 for MSc graduates) weeks** |
| General aim of the course:  Students will learn the technological methods of soil tillage to establish soil conditions that ensure the safety of crop production and to mitigate the adverse effects of climate change. They will learn about degradation processes that threaten soil conditions, methods of soil condition assessment, the characteristics of conventional and adaptive conservation tillage, their effects on soil and the environment, and tillage methods to prevent environmental damage.  1. Soil characteristics determining the quality of tillage  2. Purpose, function, importance, operational elements and procedures of soil tillage  3. The concept of the tillage system and the criteria choosing it, the classical sequence of tillage  4. Early and late tillage systems for summer and autumn sown crops after preliminary events  5. Soil management system for spring-sown crops  6. Factors determining the arable land use, depth of cultivation and basic practices for each soil type.  7. Degradation processes affecting soil fertility. Physical degradation: causes of and prevention possibilities  8. Characteristics and accompanying phenomena of the traditional tillage system. New tillage trends and systems.  9. The applicability of soil protecting, reduced tillage systems in Hungary  10. The applicability, steps, advantages and limitations of a tillage system based on a heavy duty cultivator and a loosener. Applicability, steps, advantages, limitations and barriers of a disc tillage system.  11. The applicability, steps, advantages and limitations of a seeding cultivator tillage system. Applicability, steps, advantages and limitations of a strip-tillage system. Applicability, steps, advantages and limitations of direct sowing  12. Characteristics of good quality ploughing, factors determining the quality and depth of ploughing  13. Parts of the plough, ploughing methods. Finishing ploughing.  14. The need for and purpose of subsoiling. Methods of subsoiling.  General aim of the course:  Students will learn about the practical issues of soil quality improvement, conservation and the relationship between site, mechanisation and management conditions.  1. Quality assessment of soil tillage, concepts, definitions.  2. Soil testing instruments, carrying out field measurements.  3. Field studies to determine the quality of soil cultivation.  4. Instruments for measuring soil compactness.  5. Carrying out and evaluating field soil compactness measurements.  6. Steps in the preparation of soil compaction maps.  7. Factors determining the timing and depth of subsoiling.  8. Aspects of planning subsoiling.  9. Factors determining the quality of ploughing. Evaluation of soil conditions in the case of conventional tillage.  10. Aim of planting competitions, evaluation criteria, scoring.  11. No-tillage systems.  12. Assessment of soil condition in the case of no-tillage.  13. Calculation exercise to evaluate the effect of soil loosening.  14. Calculation exercise to assess the impact of soil compaction. |
| **Required and recommended reading:** |
| **Required reading:**  1. Birkás M. (2006): Környezetkímélő, alkalmazkodó talajművelés. Akaprint Nyomdaipari  Kft. Budapest. 366 pp. ISBN: 9630602598  2. Birkás M. (2010): Talajművelők zsebkönyve. Mezőgazda Kiadó. Budapest. 282. pp. ISBN  978-963-286-626-0  *3.* Birkás M. (2017): Földműveléstan és Földhasználat. Mezőgazda Lap- és Könyvkiadó, Budapest. 481 pp. ISBN: 978-963-286-728-1  **Recommended reading:**  4. Coughenour C.M., Chamala S. (2000) Conservation Tillage and Cropping Innovation.  Iowa State University Press, Ames, Iowa. 360 pp. ISBN: 978-081381947 |
| **Competencies to be acquired, related to the course:** |
| **a) Knowledge:**  - - Students will have general and specific knowledge of their field and the theoretical and practical  knowledge is organised into a system.  - They have the practical methods, tools and knowledge needed to practice their profession on a long-term basis and to a high level.  - Knowledge of the main theories and problem-solving methods in the field.  **b) Ability:**  - - Ability to perform the job according to their qualifications.  - Planning and solving their tasks using specific and complex applications, choosing the necessary methods and tools.  - developing their knowledge by applying certain methods of knowledge acquisition and self-development, and are able to use state-of-the-art information and communication tools.  - Recognise the link between personal development and service to the common good.  **c) Attitude:**  - - They are open to new findings and innovations in their field, and strive to learn, understand and apply them, as well as to continuously educate themselves.  - Decisions in new and unexpected situations are taken in consideration and full compliance with the law and ethical standards.  - Collaborate with professionals related to their profession but working in other fields.  **d) Autonomy and responsibility:**  - - Work independently, with continuous self-monitoring.  e. - Take responsibility for the work, results and failures of their own team |

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| **Course leader** (name, post, academic degree): **Dr. Adrienn Széles, Associate Professor, PhD** |
| **Other lecturer(s) involved in teaching the course, if any** (name, post, academic degree): **Árpád Illés, assistant lecturer** |

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| Name of course: **Crop production I.** | **Credit value: 4** |
| **Course** **classification**: obligatory | |
| **The proportion of the practical nature of the course, „educational character”: 50-50%** | |
| **Type of course:** theoretical / practical, and the **total number: 28+28 hours** in the given **semester.**  Further (unique) means and properties of knowledge transfer: | |
| **Exam** type (colloquium / practical grade / **other** ):  **colloquium**  Further (unique) means of knowledge verification**:** | |
| The curricular **place of the course** (which semester): 3 | |
| Prerequisites (if any): **-** | |

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| **Course description: a brief, but informative description of the knowledge to be acquired (14 weeks).** |
| Our main tasks and aims to give theoretical and practical knowledge of crop production to MSc students. The students get wide information about the conventional and integrated crop production focusing on cereal management. This course gives a lot of quantitative and qualitative informations and innovative-scientific knowledge to students. The students are able to use and develop their scientific and practical knowledge in the farm management.  Week 1. Theoretical knowledge of conventional and integrated crop production.  Week 2. Elements of conventional and integrated crop production  Week 3. Practical knowledge of conventional and integrated crop production  Week 4. General aspects of conventional and integrated cereal production I.  Week 5. General aspects of conventional and integrated cereal production II.  Week 6. Special aspects of conventional and integrated cereal production I.  Week 7. Special aspects of conventional and integrated cereal production II.  Week 8. Agrotechnical management models in the conventional and integrated cereal crops  Week 9. Conventional and integrated wheat production I.  Week 10. Conventional and integrated wheat production II.  Week 11. Conventional and integrated wheat production III.  Week 12. Conventional and integrated maize production I.  Week 13. Conventional and integrated maize production II.  Week 14. Conventional and integrated maize production III. |
| **Required and recommended reading:** |
| **Required reading:**  Dr. Rajendra Prasad (ed.) Textbook of Field crop production I (New Delhi, 2018, Fourth Edition)  II (New Delhi, 2018, Fourth Edition)  **Recommended reading:**  J.H. Martin–R.P. Waldren–D.L. Stamp: Principles of Field crop production (2006, Fourth Edition, Pearson-Prentice Hall) |
| **Competencies to be acquired, related to the course:** |
| **a) Knowledge:**  **-** Understands the reasons for connecting crop production to related disciplines, understands and systematizes the connections  - She/he knows in detail the connections between crop production and food chain safety.  **b) Ability:**  **-** Able to orientate and form a professionally grounded opinion in domestic and international economic policy and social events and phenomena related to crop production and agriculture.  - Ability to use state-of-the-art information technology tools to implement professional, effective oral and written communication.  **c) Attitude:**  - Her/his professional interest has deepened and solidified.  - It is important for her/him to adhere to the ethical rules and norms of scientific research.  **d) Autonomy and responsibility:**  - Has autonomy as to the way in which crop production activities are carried out.  - Able to manage independently, with an environmental approach, to apply and develop modern agricultural technologies related to crop production. |

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| **Course leader** (name, post, academic degree): **Dr. Peter Pepó, professor DSc** |
| **Other lecturer(s) involved in teaching the course, if any** (name, post, academic degree): **-** |

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| Name of course: **Crop production II** | **Credit value: 3** |
| **Course** **classification**: compulsory | |
| **The proportion of the practical nature of the course, „educational character”:** | |
| **Type of course:** 28theoretical / 28 practical, and the **total number: 56 hours** in the given **semester.**  Further (unique) means and properties of knowledge transfer: | |
| **Exam** type (colloquium / practical grade / **other** ):  **colloquium**  Further (unique) means of knowledge verification**:** | |
| The curricular **place of the course** (which semester): 4 | |
| Prerequisites (if any): **-** | |

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| **Course description: a brief, but informative description of the knowledge to be acquired (14 weeks).** |
| Our main tasks and aims to give theoretical and practical knowledge of crop production to MSc students. The students get wide information about the conventional and integrated crop production focusing on cereal management. This course gives a lot of quantitative and qualitative informations and innovative-scientific knowledge to students. The students are able to use and develop their scientific and practical knowledge in the farm management.  Week 1. Theoretical knowledge of conventional and integrated crop production.  Week 2. Elements of conventional and integrated crop production  Week 3. Practical knowledge of conventional and integrated crop production  Week 4. General aspects of conventional and integrated cereal production I.  Week 5. General aspects of conventional and integrated cereal production II.  Week 6. Special aspects of conventional and integrated cereal production I.  Week 7. Special aspects of conventional and integrated cereal production II.  Week 8. Agrotechnical management models in the conventional and integrated cereal crops  Week 9. Conventional and integrated wheat production I.  Week 10. Conventional and integrated wheat production II.  Week 11. Conventional and integrated wheat production III.  Week 12. Conventional and integrated maize production I.  Week 13. Conventional and integrated maize production II.  Week 14. Conventional and integrated maize production III. |
| **Required and recommended reading:** |
| **Required reading:**  Pepó, P. Csajbók, J. (2013) Integrated crop production I. Debrecen, Debreceni Egyetem, 161 p. ISBN: 9789634736509  Pepó, P. Csajbók, J. (2013) Integrated crop production II. Debrecen, Debreceni Egyetem, 208 p. ISBN: 9789634736516  Pepó, P. Csajbók, J. (2013) Integrated crop production III. Debrecen, Debreceni Egyetem, 178 p. ISBN: 9789634736523  **Recommended reading:**  McMahon, M., Kofranek, A. M., Rubatzky, V.E.: 2010. Plant Science: Growth, Development, and Utilization of Cultivated Plants. Prentice Hall, ISBN: 9780135014073 674. p.  Bradshaw J.E.: 2012. Root and Tuber Crops. 7/Handbook of Plant Breeding Springer New York, ISBN: 9781461426691, 298 p |
| **Competencies to be acquired, related to the course:** |
| 1. **Knowledge:**  * Acquired basic knowledge of natural, technical, economic sciences, technologies, food-chain security giving the basis for crop production * Acquired knowledge to up-to date technologies used in crop production and their practical application * Students will be able to proactively learn new skills and develop self for present and future progression in crop production * Students are capable to do adequate professional communication; can participate in the crop production process directly or support it; * Students actively and operatively attend to implementation of R&D projects connecting to crop production  1. **Skills:**  * Ability in recognizing and solving the routine like problems occurring in the crop production processes * Students can understand and observe the law, protocols and regulations connecting to crop production  1. **Attitude:**  * Main feature is the constructive approach to the professional questions of crop production * Students look for ways to change work methods to improve performance in crop production * Health of the individual and society beside of environmental protection plays an important part in the professional decisions  1. **Autonomy and responsibility:**  * Students are able to bear the responsibility of the decisions and responsible for own and the attached workforce’s work * Students are decisive at the right time * Based on the professional knowledge students can set up the implementation plan of R&D projects independently, and bear the responsibility of direct managing of the development activity in crop producion |

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| **Course leader** (name, post, academic degree): **Dr. habil József Csajbók, associate professor, Ph.D.** |
| **Other lecturer(s) involved in teaching the course, if any** (name, post, academic degree): **-** |

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| Name of course: **Plant biotechnology** | **Credit value: 3** |
| **Course** **classification**: obligatory | |
| **The proportion of the practical nature of the course, „educational character”:** | |
| **Type of course:** theoretical / practical, and the **total number: hours** in the given **semester.**  Further (unique) means and properties of knowledge transfer: **14 th. / 14 pr.** | |
| **Exam** type (colloquium / practical grade / **other** ):  **colloquium**  Further (unique) means of knowledge verification**: midterm test from practical topics** | |
| The curricular **place of the course** (which semester): **second semester** | |
| Prerequisites (if any): **- BSc level knowledge of plant anatomy, physiology and biochemistry** | |

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| **Course description: a brief, but informative description of the knowledge to be acquired (14 weeks).** |
| The aim of the course is to acquaint students with the history and development of biotechnology. They will also learn about the theoretical and practical perspectives of plant biotechnology by presenting methods and strategies in in vitro cell biology, tissue culture, molecular biology, proteomics, biorefinery, and circular economy. Based on the 14-hour lecture, students can learn about the solutions that plant biotechnology offers to the current challenges of field crop production, taking into account national and international results. The lectures are complemented by a 14-hour laboratory exercise. During these, students have the opportunity to learn about and actively participate in the most important in vitro plant cell biology, tissue culture, protein extraction and proteomic techniques, as well as special biochemical analytical methods in the field.   |  |  | | --- | --- | | Lecture | Practise | | 1.-2. hours: History of biotechnology and plant tissue culture | 1.-2. hours: Presentation of a plant *in vitro* laboratory, acquaintance with the rules of sterile work | | 3 – 4 hours: Biotechnology of asexual reproduction: Micropropagation. Somatic embryogenesis, somatic seeds / somatic seedlings. Tissue culture in a bioreactors. | 3-4. hours: Micropropagation: direct/indirect organogenesis | | 5-6. hours: Biotechnological methods of sexual reproduction. Haploidy, diploid technique | * 1. hours: Somatic embryogenesis,   production of artificial seeds by encapsulation. Automatization in plant tissue culture - plant cloning bioreactors. Elicitation. | | 7-8. hours: *In vitro* gene banks, virus elimination, cryopreservation | * 1. hours: Anther culture, *in vitro* androgenesis; embryo preparation. | | * 1. hours: Fortification - enhancing crops value by agronomic and genetic methods | 9-10. hours: Green biomass processing for biorefinery purposes. Protein determination by spectrofotometric method. Proteomic analysis by 1D/2D SDS PAGE - isoelectric focusing | | 11 – 12 hours: Protein biotechnology, green biorefinery | 11-12. hours: Proteomic analysis by 1D/2D SDS PAGE – gel electrophoresis and evaluation | | * 1. hours: Role of biotechnology in agriculture waste management | 13-14. hours: Histochemical and biochemical analysis of fractionated green biomass | |
| **Required and recommended reading:** |
| **Required reading**:  Lecture and practical material (pdf)  **Recommended reading**:  Altman A., Hasegawa P.M. (2012): Plant biotechnology and agriculture (Prospects for the 21st century)  Kardung M. et al. (2020): Development of the Circular Bioeconomy: Drivers and Indicators |
| **Competencies to be acquired, related to the course:** |
| **a) Knowledge:**  During the lectures, students will acquire knowledge about the answers that the state of art plant biotechnology can offer to the current challenges related to crop production. During laboratory practices students will learn about the basic procedures used in plant biotechnology and the most commonly used model organizations.  **b) Ability:**  He/she is aware of the cellular, tissue and molecular techniques that can be used in the propagation and breeding of crops. Also, he/she is aware of the biotechnological methods possibilities in the application of agricultural crops for feed / food and industrial purposes. Able to perform professional tasks in laboratory in the field of plant biotechnology. Along with, he/she is able to expand his / her own professional knowledge of plant biotechnology.  **c) Attitude:**  He/she seeks to continuously increase his/her knowledge of plant biotechnology, including further training at the PhD level and participation in professional further training. He/she behaves in an environmentally and nature-conscious manner at work and beyond.  **d) Autonomy and responsibility:**  He/she has ability to constructively collaborate and liaise with leaders, co-workers at the workplace. He/she expresses his/her opinion responsibly in professional and non-professional circles on issues related to the biotechnological use of crops. |

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| **Course leader** (name, post, academic degree): **Dr. Éva Domokos-Szabolcsy PhD assistant professor** |
| **Other lecturer(s) involved in teaching the course, if any** (name, post, academic degree): **Prof. Dr. Miklós Fári full professor, László Kaszás assistant lecturer; Dr. Tarek Alshaal PhD associate professor** |

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| Name of course: **Diseases of cropland plants** | **Credit value: 3** |
| **Course** **classification**: obligatory | |
| **The proportion of the practical nature of the course, „educational character”: 50-50 (credit %)** | |
| **Type of course:** theoretical / practical, and the **total number:** 14 hours theoretical + 14 hours practical lesson in the given **semester.**  Further (unique) means and properties of knowledge transfer: | |
| **Exam** type (colloquium / practical grade / **other** ):  **colloquium**  Further (unique) means of knowledge verification**:** | |
| The curricular **place of the course** (which semester): 2. | |
| Prerequisites (if any): **-** | |

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| **Course description: a brief, but informative description of the knowledge to be acquired (14 weeks).** |
| 1. Diseases of the wheat/I. 2. Diseases of the wheat/II. 3. Barley, rye and oat diseases 4. Diseases of the maize/I. 5. Diseases of the maize/II. 6. Diseases of the sunflower 7. Diseases of the sugarbeet 8. Diseases of the potato 9. Diseases of the soybeans 10. Diseases of the peas 11. Diseases of the beans 12. Diseases of the cucurbits 13. Diseases of the rapeseed 14. Diseases of the alfalfa and clovers |
| **Required and recommended reading:** |
| **Required reading:** **George Agrios: Plant Pathology 5th Edition. ISBN: 9780120445653 Academic Press 2005., 952 pp.**  **Recommended reading: Compendium of Diseases, Disorders and Pests series of the APS Press. American Phytopathological Society** |
| **Competencies to be acquired, related to the course:** |
| **a) Knowledge:**  - The student knows the scientific basics of crop cultivation and phytopathological phenomenons.  - The student nknows the basic of the production of healthy, toxin and pesticide residue free plant based products with high biological value.  - The student knows the basics of prediction, prevention, the means of treatment, and the safety measures of their usage.  **b) Ability:**  - The student is able to approach phytopathological and aricultural problems in a versatile aspects, based on multidisciplinary foundations.  - The student is able to determine, plan, and organize, control and suprvise agricultural and phytopathological technologies.  **c) Attitude:**  - The student is commited to solve technical problems in a professional way, supported by scientific knowledge.  - The student shows deep and well-estabilished professional interest.  **d) Autonomy and responsibility:**  - The student has autonomy in carrying out agricultural and some pest control activities.  - The student is able to think in an autonome, safe and environmentally friendly way, and apply and develop modern agricultural devices and technologies. |

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| **Course leader** (name, post, academic degree): **Dr. Gábor Tarcali, senior research fellow, PhD** |
| **Other lecturer(s) involved in teaching the course, if any** (name, post, academic degree): **András Csótó, tech. assistant** |

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| Name of course: **Animal pests of crops** | **Credit value: 3** |
| **Course** **classification**: compulsory | |
| **The proportion of the practical nature of the course, „educational character”: 40 %** | |
| **Type of course:** theoretical / practical, and the **total number: 28 hours** (14 lectures and 14 practices) in the given **semester.**  Further (unique) means and properties of knowledge transfer: 1 lecture + 1 practice per week | |
| **Exam** type (colloquium / practical grade / other): animal and damage recognition (for practical grade) and colloquium  Further (unique) means of knowledge verification**:** | |
| The curricular **place of the course** (which semester): 2nd | |
| Prerequisites (if any): **-** | |

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| **Course description: a brief, but informative description of the knowledge to be acquired (14 weeks).** |
| Basic and applied biology, ecology, biogeography and invasion biology of animal pests. Characterisation of the most important pests of cereals, maize, potato, tobacco, sugar beet, sunflower, rape, legumes, potato, green pepper, and onion belonging to Nematodes, Gastropods, Insects and Acari. Their morphology, distribution, habitat preference, host plant, life cycle and damage. Most widespread sampling and monitoring methods of the studied pests. Characterisation of the most common beneficial organisms (pollinators, predators, parasites) belonging to the learned groups and their use in the integrated plant management (IPM).  Lecture:   1. Introduction: IPM, basic biology and ecology of animal pests I. 2. Polyphagous pests of crops I. 3. Polyphagous pests of cops II. 4. Animal pests of cereals 5. Animal pests of maize 6. Animal pests of potato, tobacco 7. Animal pests of sugar beet 8. Animal pests of sunflower and rape 9. Animal pests of alfalfa 10. Animal pests of legumes (pea, soy, and bean) 11. Animal pests of potato, green pepper, and onion 12. Invasions in general and invasive species in the Hungarian fauna 13. Biological control. 14. Beneficial organisms, predators and parasites of the learned pests and its use in IPM technology.   Practice:   1. Basic biology and ecology of animal pests II.   2-13. Morphology and identification of the learned pests and their damage on different host plants.  14: Sampling methods and pest monitoring. |
| **Required and recommended reading:** |
| **Required reading:**   1. Marczali Zs. (2020): Modul of applied entomology: Field pests in temperate zone of Europe http://dtk.tankonyvtar.hu/xmlui/handle/123456789/2953 2. Pénzes-Kónya, E. & Varga J (2020): Ecology for students of Medical Plant Production Expert higher level vocational training programme. https://dtk.tankonyvtar.hu/handle/123456789/3634   **Recommended reading:**   1. Marczali Zs. (2020): Insect ecology https://dtk.tankonyvtar.hu/handle/123456789/2949 2. Marczali Zs. (2020): Insect Physiology https://dtk.tankonyvtar.hu/handle /123456789/3205 |
| **Competencies to be acquired, related to the course:** |
| **a) Knowledge:**   * knowledge of Integrated Plant Management theory and its use in agriculture * basic knowledge in biology and population ecology of invertebrate pests of crops * basic knowledge of monitoring methods * deep knowledge of the economically most important Nematoda, Gastropoda, Insect and Acari pests and beneficial organisms belonging to these taxa   **b) Ability:**   * autonomous use of microscopes and identification keys in identification of pests * recognition of most important pests of the studied taxa and symptoms caused by them * autonomous use of the most common sampling methods and equipment against the learned pests   **c) Attitude:**   * self-determination * initiative   **d) Autonomy and responsibility:**   * Able to work both autonomously and in cooperation with colleges. * Able to make a decision based on knowledge of the subject. |

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| **Course leader** (name, post, academic degree): **Dr. Antal Nagy PhD associate professor** |
| **Other lecturer(s) involved in teaching the course, if any** (name, post, academic degree): **-** |

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| Name of course: **weed control** | **Credit value: 3** |
| **Course** **classification**: compulsory | |
| **The proportion of the practical nature of the course, „educational character”: 50/50** | |
| **Type of course: 1** theoretical / **1** practical, and the **total number: 28 hours** in the given **semester.**  Further (unique) means and properties of knowledge transfer:   * **Definition of weed, harms of weeds.** * **Life types of weeds.** * **Identification of weed species.** * **Students will learn the temporal appearance of weeds and effective and (in many cases) preventive protection against them.** * **Will be able to use different chemical- weed control methods**. | |
| **Exam** type (colloquium / practical grade / **other** ):  **colloqium**  Further (unique) means of knowledge verification**:**   * **weed identifications** * **will be able to use herbicide in the crop production** | |
| The curricular **place of the course** (which semester): **II. semester** | |
| Prerequisites (if any): **Plant physiology** | |

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| **Course description: a brief, but informative description of the knowledge to be acquired (14 weeks).** |
| 1. Definition of weed, harms of weeds.  2. Life types of weeds.   * 1. Identification of weed species.   6. Method of weed control  7. Weed control of cereals (wheat, barley etc.)  8. Weed control of maize  9. Weed control of sunflower   1. Weed control of rapeseed   11. Weed control of potato  12. Weed control of tobacco  13. Weed control of root vegetables (onion, carrot, beet etc.)  14. Weed control of fruit trees, soft berry fruits, grape. |
| **Required and recommended reading:** |
| **Required reading:**   * Alden S. Crafts (1975): Modern Weed Control. University of California Press. ISBN 0-520-02733-7 * Cobb, A., Reade, J. (2010): Herbicides and Plant Physiology. Wiley Ltd. USA ISBN-13: 978-1-4051-2935-0 * Steven R. R., Jodie S. H. (1984): Weed Ecology Implications for Vegetation Management. A Wiley-Interscience Publication. USA ISBN 0-471-87674-7   **Recommended reading:**   * Haflinger, E., Scholz, H (1981): Grass weeds. Ciba-Geigy Ltd. Switzerland |
| **Competencies to be acquired, related to the course:** |
| **a) Knowledge:**  - Student will learn the scientific, technical, technological, basic concepts of food chain safety, management.  **b) Ability:**  - Students will know the interaction between the environment and agricultural production and will be able to make decision with a complex approach in work.  **c) Attitude:**  - Their work is characterized by high standard.  - They will be able to stand up for their views, but are open to others’ opinions as well.  **d) Autonomy and responsibility:**  - They will be able to recognize the risks and boundaries of their decisions.  - They will have an independent sense of professional responsibility. |

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| **Course leader** (name, post, academic degree): **Arnold Szilágyi, assistant lecture** |
| **Other lecturer(s) involved in teaching the course, if any** (name, post, academic degree): **-** |

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| Name of course: **Crop production economics** | **Credit value: 3** |
| **Course** **classification**: Complementary course | |
| **The proportion of the practical nature of the course, „educational character”:** | |
| **Type of course:** theoretical + practical, and the **total number: 2+2hours** in the given **semester.**  Further (unique) means and properties of knowledge transfer: | |
| **Exam** type (colloquium / practical grade / **other** ): colloquium  Further (unique) means of knowledge verification**:** | |
| The curricular **place of the course** (which semester): 4. | |
| Prerequisites (if any): **-** | |

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| **Course description: a brief, but informative description of the knowledge to be acquired (14 weeks).** |
| Crop production economics is an applied field of economic science that is concerned with the  application of the principle of economics to the utilization of economic resources in the farming  industry. The focus is to impart useful skills on the students in order to enhance their skills in the application of quantitative techniques to the analysis of agricultural production problems/trends.  The goal of this course is to provide students with an introductory knowledge and a basic set of managerial skills that prepare them for advanced course work in agribusiness management and/or  rudimentary competency in managing an agribusiness firm, farm or ranch. Presentation is by  lecture integrated with experiential learning. |
| **Required and recommended reading:** |
| **Required reading:**  Sectorial Economy II., ed. István Szűcs (2013), University of Debrecen  Materials of lectures, 2021  **Recommended reading:**   * Sectorial Economy I. Ed: András Nábrádi (2013) University of Debrecen * The Future Of Food And Agriculture: Trends And Challenges, 2017, Fao * EU Farm Economics Overview, 2021. |
| **Competencies to be acquired, related to the course:** |
| **a) Knowledge:**  - Graduates will be able to collect and utilize data needed to prepare operative plans of the company’s crop production, make decisions, apply operative planning methods, assess the situation and make proposals for the realization of business development goals.  They will have acquired the synthesized knowledge of the fundamental, comprehensive concepts, theories, sector-level relationships of functions and processes.  As part of crop production operative planning, they will be know and apply the toolkit and methodology of operative planning, recognize its role in the company's operations and its relationship with other processes and functions of the organization.  **b) Ability:**  - Graduates will be able to plan and analyze an agricultural company’s crop production activity. By applying principles and methods studied, they will explore, and analyze data, and draw conclusions independently from them. and make comments, proposals for decision-making.  They will be able to recognize and adapt to market changes.  **c) Attitude:**  - For delivering work to a high standard of quality, graduates will adopt a problem sensitive, proactive approach and they will be constructive, cooperative and initiative in projects or teamwork.  They will seek to develop their stand-alone task solution.  **d) Autonomy and responsibility:**  - In a supervised professional work environment, they will be able to work and organize activities set out in their goals independently. They will take responsibility for their analyses, conclusions and decisions. They will be able to work independently (methodology and technique selection; organization, planning work; data collection, systematization, analysis and evaluation; general and professional development). |

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| **Course leader** (name, post, academic degree): **Beata Bittner, assistant professor, Ph.D.** |
| **Other lecturer(s) involved in teaching the course, if any** (name, post, academic degree): **-** |

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| Name of course: **Introduction to EU Law** | **Credit value: 3** |
| **Course** **classification**: compulsory / optional | |
| **The proportion of the practical nature of the course, „educational character”: 50/50** (credit%) | |
| **Type of course:** theoretical / practical, and the **total number: 28 hours** in the given **semester.**  Further (unique) means and properties of knowledge transfer: | |
| **Exam** type (colloquium / practical grade / **other** ): exam / practical course mark  Further (unique) means of knowledge verification**: essay submission** | |
| The curricular **place of the course** (which semester): semester 4 | |
| Prerequisites (if any): **-** | |

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| **Course description: a brief, but informative description of the knowledge to be acquired (14 weeks).** |
| The lectures focus on the most topical issues of environmental, food and agricultural law (including non-binding documents) at universal and EU level. They cover both the current activities and the most relevant pieces of legislation of the selected environment, food and agriculture-related organisations.   1. Introduction to law, and the history of the European integration 2. General Comment No. 12 on right to food and General Comment No. 15 on right to water 3. The European Council and the Council of the European Union, with special regards to AGRIFISH and ENVI Council configurations 4. The European Commission, with special emphasis on DG AGRI, DG ENVI and DG JRC 5. The European Parliament, and the Court of Justice of the European Union 6. Farm to Fork Strategy (For a fair, healthy and environmentally-friendly food system) 7. The European Food Safety Authority and the Regulation (EC) No 178/2002 on general principles and requirements of food law 8. Community Plant Variety Office (CPVO) 9. Regulation (EC) No 1107/2009 concerning the placing of plant protection products on the market I. 10. Regulation (EC) No 1107/2009 concerning the placing of plant protection products on the market II. 11. The EU’s Common Agricultural Policy (CAP) 12. The organic farming in the EU and the EU organic logo 13. The Food and Agriculture Organisation (FAO) 14. The European Environment Agency (EEA) |
| **Required and recommended reading:** |
| **Required reading:**  1. David Langlet, *EU environmental law and policy*, Oxford ; New York : Oxford University Press, 2016, 386 p.  2. Hope Johnson, *International agricultural law and policy: a rights-based approach to food security*, Cheltenham, Edward Elgar Publishing, 2018, 368 p.  3. Mary Jane Angelo and Anél Du Plessis (Eds.), *Research handbook on climate change and agricultural law,* Cheltenham, Edward Elgar Publishing, 2017, 472 p.  **Recommended reading:**  Gert Wurtenberger; Paul van der Kooij; Bart Kiewiet; Martin Ekvad, *European Union Plant Variety Protection*, 3rd Edition, Oxford University Press, 2021, ISBN: 9780192898234 |
| **Competencies to be acquired, related to the course:** |
| **a) Knowledge:**   * sound knowledge of the most important international organisations and the EU institutions and bodies in the field of environment, food and agriculture * the knowledge of the different legal, policy and scientific sources in relation to environment, food and agriculture at EU and international level   **b) Ability:**   * ability to evaluate legal, policy and scientific documents regarding environment, food and agriculture based, among others, on their binding effect, geographical scope, the organisation who published them * ability to carry out independent research regarding environment, food and agriculture by utilizing the databases and publications of a wide range of organisations   **c) Attitude:**   * sensitivity to the complexity of food and agriculture-related issues, which often make it necessary to examine these topics by involving the three pillars of sustainable development, such as the environmental, social and economic pillars   **d) Autonomy and responsibility:**   * ability to take into account the legal, ethical, social and economic considerations and consequences of environment, food and agriculture, which can often come up simultaneously |

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| **Course leader** (name, post, academic degree): **Dr. Ágnes Bujdos, PhD, IP Lawyer** |
| **Other lecturer(s) involved in teaching the course, if any** (name, post, academic degree): **-** |

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| Name of course: **Precision farming** | **Credit value: 3** |
| **Course** **classification**: obligatory | |
| **The proportion of the practical nature of the course, „educational character”: 67-33%** | |
| **Type of course: 28** theoretical / 14 practical, and the **total number: 42 hours** in the given **semester.**  Further (unique) means and properties of knowledge transfer: | |
| **Exam** type (colloquium / practical grade / **other** ):  **colloquium**  Further (unique) means of knowledge verification**:** | |
| The curricular **place of the course** (which semester): 4 | |
| Prerequisites (if any): **-** | |

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| **Course description: a brief, but informative description of the knowledge to be acquired (14 weeks).** |
| This course gives wide theoretical and practical knowledge of conventional and precision crop management to MSc students. We focus the student’s attention on the interdisciplinarity of crop production. This course provide complex knowledge how to use the elements of precision crop production in different ecological and biological conditions.  Week 1. Possibilities and barriers in traditional and precision crop production.  Week 2. Agrotechnical factors in the introducing of precision agriculture.  Week 3. Hardwares and softwares in precision agriculture.  Week 4. Off-line and on-line elements in precision crop production.  Week 5. Advantages and unadvantages in precision crop production.  Week 6. Ecological, genetic and agritechnical circumstances in precision crop production.  Week 7. Nutrient management in precision crop production.  Week 8. Tillage systems in precision crop production.  Week 9. Sowing technologies in precision crop production.  Week 10. Crop protection in precision crop production.  Week 11. Water management-irrigation in precision crop production.  Week 12. Harvest in precision crop production.  Week 13. Technical conditions in precision crop production.  Week 14. Further development in precision crop production, digitalization in crop management. |
| **Required and recommended reading:** |
| **Required reading:**  Dr. Rajendra Prasad (ed.) Textbook of Field crop production I (New Delhi, 2018, Fourth Edition)  II (New Delhi, 2018, Fourth Edition)  **Recommended reading:**  J.H. Martin–R.P. Waldren–D.L. Stamp: Principles of Field crop production (2006, Fourth Edition, Pearson-Prentice Hall) |
| **Competencies to be acquired, related to the course:** |
| **a) Knowledge:**  - Students know in detail the current requirements of the knowledge and activity system of precision crop growing, the main theories, the overall relations, the limitations of their application, and the terminology describing them.  **b) Ability:**  Students are able to apply complex, new methods and techniques and technologies that can be used in crop production.  They are able to identify special professional problems related to precision crop models, to explore and formulate the detailed theoretical and practical background needed to solve them.  **c) Attitude:**  Students are open to learn about and practicing modern and innovative precision crop technologies.  **d) Autonomy and responsibility:**  **-**Students have autonomy as to the way in which precision crop growing activities are carried out.  They are able to manage independently, with an environmental approach, to apply and develop modern agricultural technologies related to crop production. |

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| **Course leader** (name, post, academic degree): **Dr. Peter Pepó, professor DSc** |
| **Other lecturer(s) involved in teaching the course, if any** (name, post, academic degree): **-** |

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| Name of course: **Internship** | **Credit value: 2** |
| **Course** **classification**: compulsory | |
| **The proportion of the practical nature of the course, „educational character”:** practical | |
| **Type of course:** 0theoretical / practical, and the **total number: 160 hours** in the given **semester.**  Further (unique) means and properties of knowledge transfer: | |
| **Exam** type (colloquium / practical grade / **other** ): practical grade  Further (unique) means of knowledge verification**:** | |
| The curricular **place of the course** (which semester): 2 | |
| Prerequisites (if any): **-** | |

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| **Course description: a brief, but informative description of the knowledge to be acquired.** |
| Within the frame of the course, the students will be acquainted with the plant production works and workflows. During the semester, the students follow with attention the plant production workflows from physical work to manager level. Participation in the plant production workflows, later in the practical management of these works, in full cultivation technology system of crops, respectively in the primary process works. They can integrate the academic knowledge and practical skills and experiences during the practical work. Meanwhile the students will recognize the work organization of an agricultural farm, the farm employees’ scope of activities, working hours, the procession of works. |
| **Required and recommended reading:** |
| **Recommended reading:**   1. Pepó, P. Csajbók, J. (2013) Integrated crop production I. Debrecen, Debreceni Egyetem, 161 p. ISBN: 9789634736509 2. Pepó, P. Csajbók, J. (2013) Integrated crop production II. Debrecen, Debreceni Egyetem, 208 p. ISBN: 9789634736516 3. Pepó, P. Csajbók, J. (2013) Integrated crop production III. Debrecen, Debreceni Egyetem, 178 p. ISBN: 9789634736523 |
| **Competencies to be acquired, related to the course:** |
| 1. **Knowledge:**  * Acquired practical knowledge of natural and technical factors of the crop production processes * Acquired knowledge to up-to date technologies used in crop production and their practical application * Students will be able to proactively learn new skills and develop self for present and future progression * Students are capable to participate in the crop production process directly or support it;  1. **Skills:**  * Ability in recognizing and solving the routine like problems occurring in the crop production processes  1. **Attitude:**  * Main feature is the constructive approach to the professional questions * Students look for ways to change work methods to improve performance  1. **Autonomy and responsibility:**  * Students are able to bear the responsibility of the decisions and responsible for own and the attached workforce’s work * Students are decisive at the right time * Based on the professional knowledge students can set up implementation plan of crop production process |

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| **Course leader** (name, post, academic degree): **Dr. habil József Csajbók, associate professor, Ph.D.** |
| **Other lecturer(s) involved in teaching the course, if any** (name, post, academic degree): **-** |

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| Name of course: **Agrochemistry** | **Credit value: 3** |
| **Course** **classification**: compulsory | |
| **The proportion of the practical nature of the course, „educational character”:** | |
| **Type of course: 2** theoretical / 1 practical, 2+1 and the **total number:** 42 hours 28 lectures + 14 hours practices in the given **semester.**  Further (unique) means and properties of knowledge transfer: | |
| **Exam** type (colloquium / practical grade / **other** ):  **Colloquium**  Further (unique) means of knowledge verification**:** | |
| The curricular **place of the course** (which semester): 2. semester | |
| Prerequisites (if any): **-** | |

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| **Course description: a brief, but informative description of the knowledge to be acquired (14 weeks).** |
| The general objective of the subject is to train students who are familiar with the chemical and agrochemical basics of plant nutrition and environmentally friendly nutrient management, the theoretical and practical features of plant nutrition, and the role and possibilities of nutrient supply.  Lectures:  1. Plant nutrients (essentiality, classification).  2. Chemical composition of plants (water, dry matter, ash, organic matter content).  3. Nutrient uptake of plants and influencing factors  4. Effect of nutrient supply on the yield and quality of plants.  5. Nitrogen in the soil, nitrogen uptake by plants, the role and deficiency symptoms of nitrogen  6.. The role of phosphorus in plants and potassium, deficiency symptoms  7. The role of calcium, magnesium and sulphur in plants, deficiency symptoms  8. Micronutrients and their role in plants, deficiency symptoms  9. Nitrogen fertilizers and their application  10. Slow release nitrogen fertilizers  11. Phosphorus-, potassium-, magnesium- containing fertilizers, application  12. Micronutrient containing fertilizer, application  13. Compound fertilizers, mixed fertilizers, environmental risks of chemical fertilizers.  14. Organic fertilizers  Practices:   1. Rules of soil sampling for agricultural purposes. Transport soil to the laboratory. Preparation of the laboratory soil sample 2. Extraction reagents, Extraction procedure, Standards, Calibration procedure 3. Measurement of soil pH, measurement of soil EC 4. Measurement of extractable soil phosphorus. Method of P determination. 5. Calculation of the data of soil P measurement. Interpretation of data. 6. Rules of plant sampling, 7. Measurement and calculation of plant moisture, dry matter and ash content.   8. Plant tissue test  9. The basics of making nutrient solutions for foliar fertilization. Concentration calculations  10. Preparation of nutrient solutions with different concentrations  11. Chemical characterization of different fertilizers I.  12. Chemical characterization of different fertilizers II.  13. Measurement of pH and EC of aqueous solutions of different fertilizers solutions  14. Calculation of the simplified nutrient balance |
| **Required and recommended reading:** |
| **Required reading:**  K. Mengel and EA Kirkby (1987). Principles of plant nutrition, Lang Druck AG, Liebefeld / Bern, 685p. ISBN: 3-906-535037    Benton Jones, Jr. (2001). Laboratory Guide for Conducting Soil Tests and Plant Analysis, CRC press, Taylor and Francis Group, 363p. ISBN: 0-8493-0206-4.  **Recommended reading:**  Benton Jones, Jr. (2012). Plant nutrition and soil fertility manual, CRC press, Taylor and Francis Group, 282p. ISBN: 978-1-4398-1609-7 |
| **Competencies to be acquired, related to the course:** |
| **a) Knowledge:**  - The students will have general theoretical and practical knowledge related to the field of plant nutrition.  - The students’s theoretical and practical knowledge of plant nutrition and nutrient management will be organized into a system.    **b) Ability:**  - The student will be able to implement nutrient supply in an environmentally friendly way.  - Plan and solve the tasks of plant nutrition by selecting the suitable fertilizers, methods and tools, and applying them individually and in a complex way.  **c) Attitude:**  - The students will be open to new results and innovations in nutrient management, and will seek to learn, understand and apply them.  - Pursue continuous self-education.  **d) Autonomy and responsibility:**  - The students will carry out the nutrient supply tasks independently, in an environmentally friendly way and under constant self-monitoring,  - Students will have a sense of responsibility and reflect on the consequences of their own actions. |

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| **Course leader** (name, post, academic degree): **Balláné Dr. Kovács Andrea PhD** |
| **Other lecturer(s) involved in teaching the course, if any** (name, post, academic degree): **-** |

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| Name of course: **Plant breeding and transgenic plants** | **Credit value: 3** |
| **Course** **classification**: compulsory | |
| **The proportion of the practical nature of the course, „educational character”: 50/50 (%)** | |
| **Type of course: 1** theoretical / 1 practical, and the **total number: 34 hours** in the given **semester.**  Further (unique) means and properties of knowledge transfer: | |
| **Exam** type (colloquium / practical grade / **other** ):  **colloquium**  Further (unique) means of knowledge verification**:** | |
| The curricular **place of the course** (which semester): II. semester | |
| Prerequisites (if any): **-** | |

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| **Course description: a brief, but informative description of the knowledge to be acquired (14 weeks).** |
| Course objectives:  1. History of plant breeding  2. Basic molecular genetics (definitions, basic of gene expression).  3. Basic plant biotechnology, plant reproductive biology  3. Cytology of domesticated plants, the (poli)ploidy and its importance in the plant genetic modification  4. *In vitro* haploid techniques, and their significance in plant genetic modification  5. *In vitro* micropropagation techniques of cultivated plants, their importance in plant genetic modification  6. Traditional plant breeding techniques, seed biology  7. Mendel’s genetics, and its importance in modern plant breeding and plant genetic modification  8. History of plant genetic transformation  9. Plants genetic modification by biotechnology techniques.-I.  10. Plants genetic modification by biotechnology techniques.-II.  11. Basic bioinformatics and new generation sequencing (gene expression assays).  12. GM plants legal regulations, economic aspects  13. New generation gene-editing techniques  14. Summary, test. |
| **Summary of content - practice**: The knowledge to be acquired is concise, as well as a 14 week breakdown of practice. |
| Description of goal:  Training of plant genetic and breeding, who are in possession of an appropriate economic approach, they know the cultivation of plants, knows the variety and its importance.  Skills to be learnt:   1. Plant biotechnology laboratory presentation, 2. Plant DNA/RNA isolation, the chemistry of ribonuleic acids. 3. *IN vitro* plant propagation: shoot induction, 4. *In vitro* plant propagation: in vitro seed showing 5. *In vitro* androgenesis on peper 6. *In vitro* somatic embryogenesis 7. Field practice (*Capsicum* crossing) 8. Bioassay of plant virus resistance, and their inheritance 9. Gel elektrophoresis- isolated DNA quality assays. 10. Gel elektrophoresis- isolated RNA quality assays. 11. PCR- RAPD, ISSR 12. RT-PCR 13. Molecular genetic data interpretation 14. Summary, test. |
| **Required and recommended reading:** |
| **Required reading:**  Acquaah, G. (2009). *Principles of plant genetics and breeding*. John Wiley & Sons., 584, <http://eprints.stiperdharmawacana.ac.id/105/1/%5BGeorge_Acquaah%5D_Principles_of_Plant_Genetics_and_%28BookFi%29.pdf>  **Recommended reading:**  Al-Khayri, J. M., Jain, S. M., & Johnson, D. V. (Eds.). (2015). *Advances in plant breeding strategies: breeding, biotechnology and molecular tools*. Springer International Publishing, ISBN: 978-3-319-22521-0. |
| **Competencies to be acquired, related to the course:** |
| 1. **Knowledge:**  * Knows, integrates, synthesizes and plant genetics, biotechnology development also places the disciplinary knowledge of crop genetic modification in systems * Knows the mechanism of action of the genes that can be used, work and food hygiene and as well as occupational safety regulations. * Knows plant breeding strategies.  1. **Skills:**  * They will be able of integrated plant variety management against that pose a threat to plants planning and implementation. * They will be able to perform practical plant cultivation, administrative and other plant breeding management tasks.  1. **Attitude:**  * Has the necessary knowledge to perform engineering and managerial duties. * Susceptible and suitable for cooperation. * Their work is characterized by high standard. * They are able to stand up for their views, but are open to others’ opinions as well.  1. **Autonomy and responsibility:**  * They can recognize the risks and boundaries of their decisions. * They have an independent sense of professional responsibility. * They are fully aware that in a foreign environment they always represent their country, thus influencing the picture of it by their behaviour. |

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| **Course leader** (name, post, academic degree): **Dr. Erika Kurucz, assistant professor, PhD** |
| **Other lecturer(s) involved in teaching the course, if any** (name, post, academic degree): **Dr. Antal Gabriella, assistant professor, PhD** |

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| Name of course: **Land classification and regional development** | **Credit value: 3** |
| **Course** **classification**: compulsory | |
| **The proportion of the practical nature of the course, „educational character”: 50/50%** | |
| **Type of course:** theoretical and practical, and the **total number: 28 hours** in the given **semester. 14 hours of lecture and 14 hours of practice.**  Further (unique) means and properties of knowledge transfer: - | |
| **Exam** type (colloquium / practical grade / **other** ):  **practical grade**  Further (unique) means of knowledge verification**: -** | |
| The curricular **place of the course** (which semester): 3rd semester | |
| Prerequisites (if any): **-** | |

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| **Course description: a brief, but informative description of the knowledge to be acquired (14 weeks).** |
| The aim of the course is to familiarise students with the basic characteristics of domestic land use, land classification and spatial development, the related regional and sub-regional spatial structure and rural development contexts, and the planning of spatial processes in the context of the European Union.  Curriculum   1. Property structure in Hungary (before and after the political restructuring) 2. The origin, status, conceptual framework and stages of development of land evaluation. 3. Land valuation methods. (Land evaluation basis, Golden Crown land evaluation, D-e-Meter land evaluation), landscape ecology modelling 4. Regulation and process of land-use plans 5. Land valuation, land classification, land registration, land protection provisions 6. Agricultural landscape assessment. The National Ecological Network (NECONET) 7. Land use zoning in Hungary 8. Land management. Aspects of field layout. Relationship between land use and farming. 9. Habitat protection. Habitat improvement. Farming systems 10. Basic concepts of regional planning, the role and purpose of regional planning in market economies. 11. The main theories underlying regional planning (economic zoning, centre-periphery models) 12. Territorial disparities, strategic challenges for territorial development 13. Strategic points for regional planning (population, infrastructure, sustainable development). 14. Spatial planning in practice, the main steps in regional programming |

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| **Required and recommended reading:** |
| **Required reading:**  Lazányi, J. (2012). Efficiency of land use and Europe 2020 objectives. Debrecen ; Nyíregyháza : Westsik Vilmos Foundation for Rural Development, 2012  Vink, A. P. (2013). Land use in advancing agriculture (Vol. 1). Springer Science & Business Media.  **Recommended reading:**  Lazányi, J. (2013). Labour productivity and land use efficiency in agriculture. Debrecen ; Nyíregyháza : Westsik Vilmos Foundation for Rural Development, 2013  Groenendijk, P., Kroes, J. G., & Rijtema, P. E. (1999). Environmental Impacts Of Land Use In Rural Regions: The Development, Validation And Application Of Model Tools For Management And Policy Analysis (Vol. 1). World Scientific. |
| **Competencies to be acquired, related to the course:** |
| **a) Knowledge:**  - Knowledge of the general and specific characteristics and contexts of the field. Research methods and the communication specificities of the discipline.  **b) Ability:**  - Apply theories in the field in innovative ways to solve problems.  - Collaborate with representatives of the field  - Prepare independent summaries and analyses in a scientific format.  **c) Attitude:**  - Conveys the summary and detailed problems of the profession in a credible way.  - Takes a role in putting their profession at the service of the community.  - Strives to put the latest findings in the field at the service of their own development.  **d) Autonomy and responsibility:**  - Independently develop problematic areas and carry out their activities. |

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| **Course leader** (name, post, academic degree): **Adrienn Kakuszi-Széles, PhD, associate professor** |
| **Other lecturer(s) involved in teaching the course, if any** (name, post, academic degree): **Csaba Bojtor, assistant lecturer** |

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| Name of course: **Quality control of field crops** | **Credit value: 3** |
| **Course** **classification**: compulsory | |
| **The proportion of the practical nature of the course, „educational character”: 50 %:50 %** | |
| **Type of course: 14** theoretical / 14 practical, and the **total number: 28 hours** in the given **semester.**  Further (unique) means and properties of knowledge transfer: | |
| **Exam** type (colloquium / practical grade / **other** ):  **practical grade**  Further (unique) means of knowledge verification**: written exam** | |
| The curricular **place of the course** (which semester): 2nd semester | |
| Prerequisites (if any): **-** | |

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| **Course description: a brief, but informative description of the knowledge to be acquired (14 weeks).** |
| The purpose of this subject is to improve the student’s competence for to understand the importance of different quality parameters in agricultural or food use and to prepare them for the interpretation of process and results of quality control. Its first part is about the general issues of quality control; definitions, its aims and principles. The second part summarizes the possibilities of physical, chemical and microbiological analysis used in the quality control of agricultural products, the principles of main methods used in quality analysis. The third part presents the quality requirements of agricultural products, focusing on standards, recommendations and industrial demands, the role and effects of different parameters and the importance of different analytical properties..   1. Introduction. Quality assurance methods and tools. 2. About FAO-WHO and Codex Alimentarius. 3. Sampling methods 4. Lot, primary samples, bulk samples, laboratory samples 5. Testing laboratory, accreditation. 6. Organoleptic tests 7. Cereal qualification methods 8. Quality control of grains (physical methods) 9. Quality contol of wheat and flour (rheological methods) 10. Wheat and flour tests (protein content, wet gluten content, Hagberg-falling number) 11. Quality control of industrial crops (potato) 12. Quality control of industrial crops (sugar beet) 13. Quality control of industrial crop (oil plants, sunflower) 14. Quality control of industrial crop (oil plants, rapeseed) |
| **Required and recommended reading:** |
| **Required reading:** Sipos, P. (2013): Quality analysis of Agricultural Products. University of Debrecen. ISBN:978-963-473-660-8   1. **Recommended reading:** Kent K. Stewart-John R. Whitaker (1984): Modern Methods of Food Analysis. Avi Publishing Company, INC Westport, Connecticut. ISBN: 978-94-011-7381-0 2. Marwaha, K. (2010): Control and Analysis for Food and Agricultural Products. Gene-Tech Books New Delhi India. 664. 272 p. ISBN 978-81-89729-93-6 |
| **Competencies to be acquired, related to the course:** |
| **a) Knowledge:**  - Has general and profession-specific theoretical and practical knowledge related to a specific field.  - The student's theoretical and practical knowledge is organized into a system.  **b) Ability:**  - The student plans and solves the tasks of the given profession by selecting the necessary methods and tools, applying them individually and in a complex way.  **c) Attitude:**  - The student is open to new results and innovations in the given field, strives to get to know, understand and apply them.  - Strives for continuous self-education.  **d) Autonomy and responsibility:**  - The student performs his / her work independently, with continuous self-monitoring. |

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| **Course leader** (name, post, academic degree): Dr. Diána Ungai, assistant professor, PhD |
| **Other lecturer(s) involved in teaching the course, if any** (name, post, academic degree): **-** |

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| Name of course: **Quality assurance in field crops** | **Credit value: 3** |
| **Course** **classification**: **obligatory** | |
| **The proportion of the practical nature of the course, „educational character”: 100-0%** | |
| **Type of course:** theoretical / practical, and the **total number: 28 hours** in the given **semester.**  Further (unique) means and properties of knowledge transfer: | |
| **Exam** type (colloquium / practical grade / **other**): **colloquium**  Further (unique) means of knowledge verification**: -** | |
| The curricular **place of the course** (which semester): **4.** | |
| Prerequisites (if any): **-** | |

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| **Course description: a brief, but informative description of the knowledge to be acquired (14 weeks).** |
| The aim of the subject is to acquaint students with the food safety requirements and regulations for the cultivation of plant-based food ingredients, as well as the quality tools, methods and systems (GAP, GHP, HACCP, ISO, GLOBALGAP) that can be used in crop production.   1. Concept and importance of quality 2. History of quality development 3. Quality assurance professionals 4. Process of meeting the market demands 5. Quality regulating system 6. GAP, GHP, GMP 7. GLOBALGAP 8. HACCP 9. ISO 9001 10. ISO 14001 11. TQM. Quality awards 12. Audit 13. Quality tools and techniques 1. 14. Quality tools and techniques 1. |
| **Required and recommended reading:** |
| **Required reading:**  Peles, F. – Juhász, Cs. (2014): Quality assurance. University lecture notes. University of Debrecen. /ISBN 978-963-473-656-1/ TÁMOP 4.1.2.A/1-11/1-2011-0009. 177p.  **Recommended reading:**  Vasconcellos, J.A. (2004): Quality Assurance for the Food Industry. A Practical Approach. CRC Press. 448 p.  Jacxsens, L. – Devlieghere, F. – Uyttendaele, M. (2009): Quality Management Systems in the Food Industry. Ghent University. 153p. |
| **Competencies to be acquired, related to the course:** |
| **a) Knowledge:**  - He / she knows and understands the basic concepts, contexts and processes of food chain safety.  - He / she knows in detail the connections between crop production and food chain safety.  - He / she knows and understands the principles of environmental, hygiene and food safety regulations related to crop production.  **b) Ability:**  - He/she able to take a multifaceted, interdisciplinary approach to the professional problems of crop production.  - He / she is able to exercise his / her professional activity within the legal framework.  **c) Attitude:**  - He / she is committed to the environment, nature conservation and a sustainable agricultural economy.  **d) Autonomy and responsibility:**  - He / she is able to manage independently, in an environmentally friendly way.  - He / she makes decisions with professional responsibility and demonstrates law-abiding behavior. |

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| **Course leader** (name, post, academic degree): **Dr. Ferenc Peles, assistant lecturer, PhD.** |
| **Other lecturer(s) involved in teaching the course, if any** (name, post, academic degree): **Dr. Diána Ungai, assistant lecturer, PhD.** |

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| Name of course: **Mechanization of crop production** | **Credit value: 3** |
| **Course** **classification**: compulsory | |
| **The proportion of the practical nature of the course, „educational character”: 50/50%** | |
| **Type of course: 28 hours lecture** and **28 hours practice** per semester  Total number: **56 hours** in the given semester.  Number of teaching hours / week : 2+2 (lecture and practice)  Further (unique) means and properties of knowledge transfer: farm visits, laboratory practices, field demonstrations | |
| **Exam** type (colloquium / practical grade / other):  **colloquium**  Further (unique) means of knowledge verification**: -** | |
| The curricular **place of the course** (which semester): semester 3 | |
| Prerequisites (if any): **-** | |

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| **Course description: a brief, but informative description of the knowledge to be acquired (14 weeks).** |
| The general aim of the subject:  To acquaint students with the equipment, tools, their operating principles, setting parameters and main parts used in the mechanization of crop production. Students will be become able to control the operation of machinery to plan work processes.  Topics:   1. Introduction, Internal combustion engines I. - Basics of internal combustion engines, petrol engines 2. Internal combustion engines II. - Diesel engines, auxiliary equipment of engines, electric motors 3. Tractors I. - Transmission system: clutch, gearbox, differential 4. Tractors II. - Walking gear, tractor-implement connection elements, cab, maintenance 5. Precision crop production I. - Basics: navigation systems, correction, steering 6. Precision crop production II. - Precision crop production solutions, outlook into precision livestock farming 7. Tillage machines 8. Nutrient management machines 9. Sowing machines 10. Mechanical knowledge of plant protection 11. Machines for harvesting cereals and oilseeds 12. Hay/fodder harvesting machines I. - Mowing structures, swath handling machines 13. Hay/fodder harvesting machines II. - Pick-up trailers, forage harvesters, baling, bale packing 14. Irrigation machines and equipment |
| **Required and recommended reading:** |
| **Required reading:**   * Learning materials of the lectures and practices * Herren, Ray V. Agricultural mechanics: Fundamentals & applications. Cengage Learning, 2014. ISBN: 128505895X   **Recommended reading:**   * Zhang, Qin. Precision agriculture technology for crop farming. Taylor & Francis, 2016. ISBN: 9780429159688 * Bell, Brian. Farm machinery. Fox Chapel Publishing, 2010. ISBN 1903366682 |
| **Competencies to be acquired, related to the course:** |
| **a) Knowledge:**  - Students are familiar the general and specific characteristics, boundaries, the most important development directions of their field of specialization, and its connection with other related fields.  **b) Skills:**  - Students are able to identify special professional problems with a versatile, interdisciplinary approach, explores and formulates the detailed theoretical and practical background needed to solve them.  **c) Attitude:**  - They strive to put the latest achievements in their field at the service of its own development.  **d) Autonomy and responsibility:**  - Independent planning and execution of activities. |

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| **Course leader** (name, post, academic degree): **Dr. Zoltán Hagymássy, PhD, associate professor** |
| **Other lecturer(s) involved in teaching the course, if any** (name, post, academic degree):  **Csaba Bojtor, assistant lecturer** |

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| Name of course: **Nutrient supply of field crops** | **Credit value: 3** |
| **Course** **classification**: obligatory | |
| **The proportion of the practical nature of the course, „educational character”:** 50-50 (credit%) | |
| **Type of course:** 14hours theoretical / 14 hours practical, and the **total number: 28 hours** in the given **semester.**  Further (unique) means and properties of knowledge transfer: - | |
| **Exam** type (colloquium / practical grade / **other** ): practical grade  Further (unique) means of knowledge verification**: -** | |
| The curricular **place of the course** (which semester): 3. | |
| Prerequisites (if any): **-** | |

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| **Course description: a brief, but informative description of the knowledge to be acquired (14 weeks).** |
| Current evaluation and development opportunities of nutrient management. Skill level acquisition of soil - plant - yield and quality interactions. The importance and change of soil fertility in sustainable, developable nutrient management. The role and impact of climatic factors on the efficiency of nutrient management. Importance of biological bases in nutrient utilization.   1. The purpose, task and event of fertilization. 2. Evaluation of fertilization in Hungary. 3. Analysis of the most important weather (climatic) factors in Hungary. 4. The most important characteristics of NPK fertilizers. 5. Criteria and symptoms of the significance, effect and lack of N-P-K, Mg, Ca, Zn Mn, Cu, Mo, B, Fe and other nutrients. 6. Arguments and counter-arguments related to NPK fertilization. Beneficial effects of NPK fertilization. 7. The effect of NPK and Mg + Ca nutrients on the plant, soil and environment. 8. The effect of crop rotation on nutrient demand. Soils are the effect of their natural nutrient content, mineral and organic content on nutrient dynamism. 9. Important microelements and their importance in crop production. 10. The most important aspects of plant fertilization planning. 11. Methods for determining the optimal fertilizer dose. 12. Organic fertilizers, barn fertilization. 13. Green fertilization. 14. Organic and fertilizing machines |
| **Required and recommended reading:** |
| **Required reading:**  Allen V. Barker, David J. Pilbeam: 2016. Handbook of Plant Nutrition. CRC Press. (ISBN: 9781420014877) 632 p.  **Recommended reading:**   * Harald Kosegarten, Thomas Appel. 2012. Principles of Plant Nutrition. Springer Science & Business Media (ISBN: 9401010099) 849. p. * Horst Marschner: 2012. Marschner's Mineral Nutrition of Higher Plants. (ed.: Petra) Academic Press, (ISBN: 9780123849052) 651. p. |
| **Competencies to be acquired, related to the course:** |
| **a) Knowledge:**  - Understands the reasons for connecting crop production to related disciplines, understands and systematizes the connections  - She/he knows in detail the connections between crop production and food chain safety.  **b) Ability:**  - Able to orientate and form a professionally grounded opinion in domestic and international economic policy and social events and phenomena related to crop production and agriculture.  - Ability to use state-of-the-art information technology tools to implement professional, effective oral and written communication.  **c) Attitude:**  - Her/his professional interest has deepened and solidified.  - It is important for her/him to adhere to the ethical rules and norms of scientific research.  **d) Autonomy and responsibility:**  - Has autonomy as to the way in which crop production activities are carried out.  - Able to manage independently, with an environmental approach, to apply and develop modern agricultural technologies related to crop production. |

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| **Course leader** (name, post, academic degree): **Dr.Dóka Lajos Fülöp, assistant professor, PhD** |
| **Other lecturer(s) involved in teaching the course, if any** (name, post, academic degree): **-** |

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| Name of course: **Irrigated crop production** | **Credit value: 3** |
| **Course** **classification**: compulsory | |
| **The proportion of the practical nature of the course, „educational character”:** | |
| **Type of course:** 28theoretical / 14 practical, and the **total number: 42 hours** in the given **semester.**  Further (unique) means and properties of knowledge transfer: | |
| **Exam** type (colloquium / practical grade / **other** ):  **Practical**  Further (unique) means of knowledge verification**:** | |
| The curricular **place of the course** (which semester): 3 | |
| Prerequisites (if any): **-** | |

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| **Course description: a brief, but informative description of the knowledge to be acquired (14 weeks).** |
| The main goals are to give effective academic and practical knowledge connecting to the irrigated crop production: Interaction between water management and crop production in agriculture. Knowledge about water balance and water requirement of plants. Learning of significance of environment friendly and economic irrigation. Effects of the irrigation on soil, plant and environment. Principles of irrigation, main functions of irrigation and crop production. Irrigation regime of main crops.  1st week Interaction between water management and crop production in agriculture.  2nd week Water balance of plants, water demand of plants.  3rd week Bases of water regulation in crop production.  4th week Learning of significance of environment friendly and economic irrigation.  5th week Effects of irrigation on soil and plants.  6th week Production requirements of irrigation. Aims of irrigated crop production.  7th week Necessary of irrigation, efficiency of water use.  8th week Principles of fertilization in irrigated fields.  9th week Evaluation of irrigation patterns.  10th week Main functions of irrigation and crop production.  11th week Correlations between irrigation and yield stability.  12th week Irrigation regime of main crops I. (green peas, alfalfa, red clover)  13th week Irrigation regime of main crops II. (corn, sweet corn, corn seed)  14th week Irrigation regime of main crops III. (rice, potato, sugar beet) |
| **Required and recommended reading:** |
| **Recommended reading:**   1. Burton, M. (2010): Irrigation Management: Principles and Practices, CAB Intl.ISBN: 9781845935160 2. Lee, T. S. (2012): Irrigation Systems and Practices in Challenging Environments,Intech, Rijeka, Croatia ISBN 978-953-51-0420-9 3. Esteve, Y.V, Brebbia, C.A. Rico, D.P. (2008): Sustainable Irrigation Management, Technologies and Policies II WIT Press, Southampton, UK ISBN: 978-1-84564-116-0 4. Brebbia, C.A, Marinova, M, Bjornlund, H (2010): Sustainable Irrigation Management, Technologies and Policies III, Wit Press/Computational Mechanics, Billerica, USA, ISBN: 9781845644468 5. M. H. Ali (2010)-Fundamentals of Irrigation and On-farm Water Management-Springer-Verlag New York ISBN 978-1-4419-6334-5 |
| **Competencies to be acquired, related to the course:** |
| 1. **Knowledge:**  * Acquired basic knowledge of natural, technical, economic sciences, technologies, food-chain security giving the basis for the irrigated farming * Acquired knowledge to up-to date technologies used in irrigated farming and their practical application * Students will be able to proactively learn new skills and develop self for present and future progression * Students are capable to do adequate professional communication; can participate in the crop production process directly or support it; * Students actively and operatively attend to implementation of R&D projects  1. **Skills:**  * Ability in recognizing and solving the routine like problems occurring in the irrigated crop production processes * Students can understand and observe the law, protocols and regulations connecting to irrigation  1. **Attitude:**  * Main feature is the constructive approach to the professional questions * Students look for ways to change work methods to improve performance * Health of the individual and society beside of environmental protection plays an important part in the professional decisions  1. **Autonomy and responsibility:**  * Students are able to bear the responsibility of the decisions and responsible for own and the attached workforce’s work * Students are decisive at the right time * Based on the professional knowledge students can set up the implementation plan of R&D projects independently, and bear the responsibility of direct managing of the development activity |

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| **Course leader** (name, post, academic degree): **Dr. habil József Csajbók, associate professor, Ph.D.** |
| **Other lecturer(s) involved in teaching the course, if any** (name, post, academic degree): **-** |

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| Name of course: **Research methodology and extension** | **Credit value: 3** |
| **Course** **classification**: compulsory | |
| **The proportion of the practical nature of the course, „educational character”:** | |
| **Type of course:** 14theoretical / 14 practical, and the **total number: 28 hours** in the given **semester.**  Further (unique) means and properties of knowledge transfer: | |
| **Exam** type (colloquium / practical grade / **other** ):  **colloquium**  Further (unique) means of knowledge verification**:** | |
| The curricular **place of the course** (which semester): 4 | |
| Prerequisites (if any): **-** | |

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| **Course description: a brief, but informative description of the knowledge to be acquired (14 weeks).** |
| 1st week Specialities and errors of human learning. Methods of the knowledge collecting process.  2nd week The primary, secondary and tertiary research and their characteristics. The validity and scope of the research’s results.  3rd week Ethical questions of research work.  4th week Classification of the research work  5th week The research plan and the main possible errors in it.  6th week. Basic definitions of experiments. In vitro, in vivo experiments, field experiments.  7th week Experimental methods, planning field experiments.  8th week The aims of the field experiments, factors, variables, plots, treatments, repetitions.  9th week The accuracy of the experiment data, the determinant factors, homogeneity.  10th week Estimating the experimental error, and the difference between the treatments.  11th week Real and hidden replications. Computing the required repetition number.  12th week Design variations of single and multi-factor experiments, randomization.  13th week Case studies. Evaluation of experiment’s data.  14th week Agricultural extension systems |
| **Required and recommended reading:** |
| **Recommended reading:**   * Thomas C. G. (2021): Research methodology and scientific writing Springer ISBN 978-3-030-64864-0 * Cochran, W.G. – Cox, G.M. (1966): Experimental Designs, Wiley Publications, New York USA * Kumar, Ranjit (2005): Research methodology: a step-by-step guide, SAGE * Creswell John W. (2003): Research design: qualitative, quantitative, and mixed method approaches * Kothari C.R. (2009): Research Methodology: Methods and Techniques ISBN: 978-81-224-2488-1 |
| **Competencies to be acquired, related to the course:** |
| 1. **Knowledge:**  * Acquired basic knowledge of research methodology giving the basis for the research work * Acquired knowledge to up-to date methods used in scientific research and their practical application * Students will be able to proactively learn new skills and develop self for present and future progression * Students are capable to do adequate professional communication; can participate in the research process or in the extension system directly or support it; * Students actively and operatively attend to implementation of R&D projects  1. **Skills:**  * Ability in recognizing and solving the routine like problems occurring in the scientific research * Students can understand and observe the protocols and regulations connecting to the scientific research  1. **Attitude:**  * Main feature is the constructive approach to the professional questions * Students look for ways to change work methods to improve performance * Health of the individual and society beside of environmental protection plays an important part in the professional decisions  1. **Autonomy and responsibility:**  * Students are able to bear the responsibility of the decisions and responsible for own and the attached workforce’s work * Students are decisive at the right time * Based on the professional knowledge students can set up the implementation plan of R&D projects independently, and bear the responsibility of direct managing of the development activity |

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| **Course leader** (name, post, academic degree): **Dr. habil József Csajbók, associate professor, Ph.D.** |
| **Other lecturer(s) involved in teaching the course, if any** (name, post, academic degree): **-** |

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| Name of course: **Grassland management** | **Credit value: 3** |
| **Course** **classification**: Professional/technical subject | |
| **The proportion of the practical nature of the course, „educational character”: theorentically oriented 50% theory 50 % practical** | |
| **Type of course:** theoretical / practical, and the **total number: hours** in the given **semester.**  Further (unique) means and properties of knowledge transfer: theoretical and practical with 50-50 % proportions; 14 hours theoretical and 14 hours practical lessons | |
| **Exam** type (colloquium / practical grade / **other** ):  **practical grade based on students, individual home works**  Further (unique) means of knowledge verification**: technical ppt presentations on gives topics** | |
| The curricular **place of the course** (which semester): 3rd semester | |
| Prerequisites (if any): **-** | |

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| **Course description: a brief, but informative description of the knowledge to be acquired (14 weeks).** |
| Technical terminology of grassland ecosystems;  Products and services from garsslands;  Effects of ecological conditions on grassland production;  Functional morphology of grassland plants  Most common grassland species of home country grasslands  Grassland fertilization;  Irrigation on grasslands;  Grassland establishment  Grassland improvement and renovation;  Cultivation of permanent grasslands;  Grassland production,  Grass and grassland quality;  Grazing of grasslands;  Grassland harvesting methods. |
| **Required and recommended reading:** |
| **Required reading:**  GRASS Its production and utilization (Edited by W. Holmes), Published for British Grassland Society by Blackwell Scientific Publications, Oxford, 1998, 306. p. ISBN 0-632-02461-5  **Recommended reading:**  GRASSLAND Quietness and Stregth for a New American Agriculture (Editors: Walter F. Wedin and Steven L. Fales), American Society of Agronomy Inc. etc., 2009, 256. p. ISBN 978-0-89118-171-2 |
| **Competencies to be acquired, related to the course:** |
| **a) Knowledge:**  - **Students will have basic skills on the technical and practical knowledge of grassland management.**  **b) Ability:**  - **Students will be able to perform practical job in grassland management.**  **Student can solve practical problems in grassland management by selecting relevant methods and tools.**  **c) Attitude:**  - **Students may be open minded towards the new results and innovations in grassland science/management.**  **Students may be able to transfer the role of grasslands in modern life towards the public.**  **d) Autonomy and responsibility:**  - **Students can make a job in grassland management indipendently and under self-control.**  **Student can work in grassland management with great responsibility and and will be able to reflect to consequences of their activities.** |

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| **Course leader** (name, post, academic degree): **Prof. Géza Nagy; full prof.; CSc** |
| **Other lecturer(s) involved in teaching the course, if any** (name, post, academic degree): **-** |

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| Name of course: **Communication** | **Credit value: 3** |
| **Course** **classification**: chooseable compulsory | |
| **The proportion of the practical nature of the course, „educational character”: 50-50%** | |
| **Type of course:** theoretical / **practical**, and the **total number: 28 hours** in the given **semester. 1+1**  Further (unique) means and properties of knowledge transfer: trainings, case studies | |
| **Exam** type (colloquium / practical grade / **other** ):  **practical grade**  Further (unique) means of knowledge verification**: -** | |
| The curricular **place of the course** (which semester): 4 | |
| Prerequisites (if any): **-** | |

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| **Course description: a brief, but informative description of the knowledge to be acquired (14 weeks).** |
| The aim this course to study basic communication skills. Understand the process of communication. Begin practicing listening skills. Understand the importance of nonverbal communication and of improving their nonverbal communication skills. Recognize importance of intercultural diversity of communication.  1. lecture Basic communication skills.  2. seminar Nonverbal communication  3. lecture Process of communication.  4. seminar Nonverbal communication in business  5. lecture Active listening skills.  6. seminar Effective listening skills  7. lecture Effective verbal communication skills.  8. seminar Elevator pitch  9. lecture Communication barriers.  10. seminar Communication barriers  11. lecture Intercultural communication  12. seminar Intercultural communication  13. lecture Presentation technics  14 seminar Effective presentation |
| **Required and recommended reading:** |
| **Required reading:**  Guffey, Mary Ellen – Loewy, Dana (2018): Essential of Business Communication. ISBN13 (EAN):9781337386494 South Western, 2018  **Recommended reading:**  McLean, S. (2005). The basics of interpersonal communication. Boston, MA: Allyn & Bacon  Pearson, J., & Nelson, P. (2000). An introduction to human communication: Understanding and sharing. Boston, MA: McGraw-Hill  Remillard Vincent (2016): Human communication Across Cultures. Equinox PublishingISBN13 (EAN): 9781781793558 |
| **Competencies to be acquired, related to the course:** |
| **a) Knowledge:**  - Graduated student should know, analyze, plan, manage the communication of organizations, and be able to recognize, analyze and solve communicational problems..  - Graduated student should know and apply communicational forms, know barriers and rules.  - Graduated student know and apply professional written and oral communication in life.  **b) Ability:**  - Graduated students can analyse, plan, organise and manage the process of communication, and can solve problems.  - They are able to choose between the most efficient processes and methods for problem solving. They are able to use consciously and plan in high standard.  - They are able to use references effectively and independently.  - They are able to write reports, analyses.  **c) Attitude:**  - Graduated students are able to effectively use managerial methods, forms, communicational processes  **d) Autonomy and responsibility:**  - They will be able to control processes, can manage, organise, and communicate |

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| **Course leader** (name, post, academic degree): **Dr. habil Csilla JUHÁSZ associate professor, PhD** |
| **Other lecturer(s) involved in teaching the course, if any** (name, post, academic degree): **-** |

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| Name of course: **Organic crop production** | **Credit value: 3** |
| **Course** **classification**: optional | |
| **The proportion of the practical nature of the course, „educational character”: 50-50%** | |
| **Type of course:** theoretical / practical, and the **total number: 1+1 hours** in the given **semester.**  Further (unique) means and properties of knowledge transfer: | |
| **Exam** type (colloquium / practical grade / **other** ): colloquium  Further (unique) means of knowledge verification**:** | |
| The curricular **place of the course** (which semester): 4 | |
| Prerequisites (if any): **-** | |

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| **Course description: a brief, but informative description of the knowledge to be acquired (14 weeks).** |
| The aim of the course is to acquaint students with the principles of environmentally friendly, chemical-free crop production technology, the theoretical aspects of cultivation technology elements and their possible practical implementation, just as the interactions between the individual elements. Get to know the alternative options and ways of converting traditional crop production to organic farming, the advantages and problems of organic farming, the realistic perspectives of its development.  Subject topics:  Week 1: Overview and development of traditional crop production, developmental stages.  Week 2: Environmental risks and their assessment in conventional crop production.  Week 3: Trends in organic farming.  Week 4: Principles of organic farming.  Week 5: Terms and opportunities for the transition to organic farming.  Week 6: Options for nutrient supply and maintenance of soil fertility.  Week 7: Weed control options  Week 8: Pathogen control options  Week 9: Pest control options  Week 10: Practical cultivation technology of organic farming for some main field crops.  Week 11: Organic farming and crop quality.  Week 12: Special mechanization in organic farming.  Week 13: National and international standards and vertical system of organic farming.  Week 14: Production, inspection, certification, trade in organic products. The current situation and perspectives of organic farming in Hungary and abroad |
| **Required and recommended reading:** |
| **Required reading:**  Sarath Chandran Unni M.R. Sabu Thomas (2018). Organic Farming 1st Edition  ISBN: 9780128132722, eBook ISBN: 9780128132739, p. 436  S.P. Palaniappan/K. Annadurai (2018). Organic farming theory & practice  ISBN: 9788172335380, E-ISBN: 9789387869431, p. 257  **Recommended reading:**  Franc Bavec, Martina Bavec (2019). Organic production and use of alternative crops. ISBN ‎ 978-0367453534  Edith T. Lammerts van Bueren, James R. Myers (2011). Organic Crop Breeding  ISBN:9780470958582 |
| **Competencies to be acquired, related to the course:** |
| **a) Knowledge:**  - Students know in detail the current requirements of the knowledge and activity system of crop production, the leading theories, the overall relations, the limitations of their application, and the terminology describing them.  **b) Ability:**  - Students are able to apply complex, new methods and techniques and technologies that can be used in crop production.  Students are able to identify special professional problems related to crop production, to explore and formulate the detailed theoretical and practical background needed to solve them.  **c) Attitude:**  - Openness to learn about and practicing modern and innovative crop production methods.  **d) Autonomy and responsibility:**  - It has autonomy as to the way in which crop production activities are carried out.  Able to manage independently, with an environmental-conscious approach, to apply and develop modern agricultural technologies related to crop production.  It reflects on and responsibly represents the ethical issues of crop production and evaluates the consequences of its decisions. |

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| **Course leader** (name, post, academic degree): **Dr. András Szabó assistant professor, PhD** |
| **Other lecturer(s) involved in teaching the course, if any** (name, post, academic degree): **-** |

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| Name of course: **Cultivation of medicinal plants** | **Credit value: 3** |
| **Course** **classification**: optional | |
| **The proportion of the practical nature of the course, „educational character”: 50-50%** | |
| **Type of course: B 14** theoretical / **14** practical, and the **total number: 28 hours** in the given **semester.**  Further (unique) means and properties of knowledge transfer: - | |
| **Exam** type (colloquium / practical grade / **other** ):  **practical course mark**  Further (unique) means of knowledge verification**: -** | |
| The curricular **place of the course** (which semester): 3 | |
| Prerequisites (if any): - | |

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| **Course description: a brief, but informative description of the knowledge to be acquired (14 weeks).** |
| The aim of the course is to give thematic and complex knowledge about the domestic and international importance of medicinal plant production, the particular ecological and economic conditions of cultivating medicinal plants, the cultivation technology of herbs, breeding medicinal plants, the basic processing ways and the storage of herbs and drugs and their utilization. With the acquired knowledge students will be able to grow the medicinal plant species cultivated in Hungary and process the herbs with the knowledge of quality requirements of drugs.  Thematic of subject:  1 week: The importance and tendencies of growing medicinal plants in Hungary and in the world. Agro-ecological conditions of medicinal plant production. Drugs and their systematization.  2 week: Genetical background of cultivating of medicinal plants. Gathering of medicinal plants.  3 week: General and specific methods of production technology of medicine and aromatic plants (crop rotation, nutrient supply, tillage, sowing, plant protection, harvest).  4 week: Possibilities and practice of aromatic plant production in organic farming.  5 week: Processing and storing of medicinal and aromatic crops (drying, extraction of active substances).  6 week: Qualifying of herbs and drugs.  7 week: Production of annual herbs (Coriandrum sativum, Anethum graveolens, Pimpinella anisum, Carum carvi).  8 week: Majorana hortensis, Ocimum basilicum, Satureja hortensis production  9 week: Matricyria chamomilla, Calendula officinalis, Silybum marianum Sinapis albus production  10 week: Papaver somniferum production  11 week: Production of biennial herbs (Digitalis lanata, Digitalis purpurea, Salvia sclarea).  12 week: Production of perennial herbs (Mentha piperita, Melissa officinalis, Lavandula angustifolia.  13 week: Thymus vulgaris, Levisticum officinale Production  14. week: Valeriana officinalis, Salvia officinalis Production |
| **Required and recommended reading:** |
| **Required reading:**   1. Hornok, L. (1992) Cultivation and Processing of Medicinal Plants. John Wiley & Sons Ltd, Baffins Lane, Chicester, UK 338. p. ISBN 0-471-92383-4 2. WHO guidelines on good agricultural and collection practices (GACP) for medicinal plants. World Health Organization Geneva (2003)   **Recommended reading:** |
| **Competencies to be acquired, related to the course:** |
| **a) Knowledge:**  -Knows in detail the natural science basis of the medicinal plant production. Acquainted with the correlation between the medicinal plant production and the environment and nature, knows well the basis of the processing of herb products with high biological value.  - Acquired knowledge to up-to date technologies used in production and processing of medicinal plants and their practical application  - Knows and understands the principles of saving the natural environmental and knows the environmental-, nature conservation-, hygiene- and food-chain security-, food safety and occupational safety regulations connected to the herb production.  **b) Ability:**  - Capable of versatile and interdisciplinary approach of professional problems of medicinal plant production.  - Capable of practical using complicated, new methods, techniques and technologies in medicinal plant production.  - Ability in recognizing and solving the routine like problems occurring in the medicinal plant production processes.  - Ability in determination, planning and organization of works connected to medicinal plant growing.  **c) Attitude:**  - Open minded and susceptible in acquire the innovative and up-to date professional methods and their application in the practice of the medicinal plant growing.  - Students look for ways to change work methods to improve performance  - Health of the individual and society beside of environmental protection plays an important part in the professional decisions  - Recognize and accept the risks and limits of the decisions connected to the medicinal plant production.  - Definite and persistent but accept the professionally substantiated critical remarks.  **d) Autonomy and responsibility:**  - Students are able to bear the responsibility of the decisions and responsible for own and the attached workforce’s work  - Students are decisive at the right time  - Based on the professional knowledge students can set up the implementation plan of R&D projects independently, and bear the responsibility of direct managing of the development activity  - Capable for independent and environmentally friendly medicinal plant production |

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| **Course leader** (name, post, academic degree): **Dr. Ábrahám Éva Babett assistant professor, PhD** |
| **Other lecturer(s) involved in teaching the course, if any** (name, post, academic degree): **-** |

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| Name of course: **Energy plant cultivation** | **Credit value: 3** |
| **Course** **classification**: | |
| **The proportion of the practical nature of the course, „educational character”: 50-50 (%)** | |
| **Type of course:1 practical and 1** theoretical the **total number: 28** in the given **semester.**  Further (unique) means and properties of knowledge transfer: | |
| **Exam** type (colloquium / practical grade / **other** ):  **colloquium**  Further (unique) means of knowledge verification**:** | |
| The curricular **place of the course** (which semester): 3. | |
| Prerequisites (if any): **-** | |

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| **Course description: a brief, but informative description of the knowledge to be acquired (14 weeks).** |
| Course objectives:  1. General issues of energy crop production, green industry  2. Types of biomass plants (1st, 2nd and 3rd generation energy crops; biomass crop classification)  3. The basic concepts of energy crops, green industry, Bioindustries , bio-refineries  4. Woody biomass plants  5. Perennial and annual herbaceous biomass crops  6. Biorefineries, Bio-indusry  7. Plant propagating material of green industries, breeding of energy crops, aspects of species and variety use  8. Energy crops cultivation I. : soil preparation, energy crops palantation establishment.  9. Energy crops cultivation II: Nutrition, plant protection and harvest  10. Energy plant processing, development direction  11. Agricultural innovation priorities, N, water carbon and protein issue, multi-use energy crops,: by-product utilization, phytoremediation  12. Agronomic and economic relations of energy crop cultivation, current practice, development directions  13. The energy crop production characteristics of Hungary, Hungary biomass potential  14. New cell biology tools and complex, safe molecular biology technologies in energy crop production and breeding |
| **Summary of content - practice**: The knowledge to be acquired is concise, as well as a 14 week breakdown of practice. |
| Description of goal:  Training of enerdy crop production and breeding, who are in possession of an appropriate economic approach, they know the cultivation of plants, knows the variety and its importance.  Skills to be learnt: |
| **Required and recommended reading:** |
| **Required reading:**  Strezov, V., & Anawar, H.M. (Eds.). (2019). Renewable Energy Systems from Biomass: Efficiency, Innovation, and Sustainability (1st ed.). CRC Press. https://doi.org/10.1201/9781315153971  **Recommended reading:**  N. El Bassam (2010): Handbook of Bioenergy Crops 572 pp, ISBN 9781138975712, |
| **Competencies to be acquired, related to the course:** |
| 1. **Knowledge:**  * Knows, integrates, synthesizes and biomass crop production, biotechnology development also places the disciplinary knowledge of plant breeding in systems * Knows the mechanism of bioenergy supply chain, and as well as occupational safety regulations. * Knows biomass plant breeding strategies.  1. **Skills:**  * They will be able of integrated plant variety management against that pose a threat to plants planning and implementation. * They will be able to perform practical energy plant cultivation, administrative and other plant breeding management tasks.  1. **Attitude:**  * Has the necessary knowledge to perform engineering and managerial duties. * Susceptible and suitable for cooperation. * Their work is characterized by high standard. * They are able to stand up for their views, but are open to others’ opinions as well.  1. **Autonomy and responsibility:**  * They can recognize the risks and boundaries of their decisions. * They have an independent sense of professional responsibility. * They are fully aware that in a foreign environment they always represent their country, thus influencing the picture of it by their behaviour. |

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| **Course leader** (name, post, academic degree): **Dr. Erika Kurucz, assistant professor, PhD** |
| **Other lecturer(s) involved in teaching the course, if any** (name, post, academic degree): **Dr. Gabriella Antal, assistant professor, Phd.** |

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| Name of course: **Biological bases, variety use** | **Credit value: 3** |
| **Course** **classification**: optional | |
| **The proportion of the practical nature of the course, „educational character”: 50-50%** | |
| **Type of course:** theoretical / practical, and the **total number: 1+1 hours** in the given **semester.**  Further (unique) means and properties of knowledge transfer: | |
| **Exam** type (colloquium / practical grade / **other** ):  **colloquium**  Further (unique) means of knowledge verification**:** | |
| The curricular **place of the course** (which semester): 2 | |
| Prerequisites (if any): **-** | |

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| **Course description: a brief, but informative description of the knowledge to be acquired (14 weeks).** |
| In the course Biological bases and variety use we acquaint students with the importance, conditions, legal regulation of the use of propagation material, the significance of biological bases, their peculiarities in the most important field plant species, the aspects of modern variety use and variety selection.  Subject topics:  1. The past of breeding activities in Hungary  2. Legal background and regulations in classification of biological funds  3. International Organizations for Variety Use and Seed Certification. Situation of domestic and international seed production  4. Domestic system of seed production and distribution  5. Variety protection. Economic evaluation of varieties  6. Legal regulation of the acceptance of genetically modified varieties  7. The role of biological bases in quality wheat production  8. The role of biological bases in the cultivation of other cereals  9. The role of biological bases in maize cultivation  10. The role of biological bases in sunflower cultivation  11. The role of biological bases in rapeseed cultivation  12. The role of biological bases in the cultivation of legumes  13. The role of biological bases in the cultivation of fodder plants  14. The role of biological bases in the cultivation of cereals |
| **Required and recommended reading:** |
| **Required reading:**  [Robert W. Allard](https://www.wiley.com/en-us/search?pq=%7Crelevance%7Cauthor%3ARobert+W.+Allard) (1999). Principles of Plant Breeding, 2nd Edition. ISBN: 978-0-471-02309-8, 264 p.  [Jack Brown](https://www.wiley.com/en-us/search?pq=%7Crelevance%7Cauthor%3AJack+Brown), [Peter Caligari](https://www.wiley.com/en-us/search?pq=%7Crelevance%7Cauthor%3APeter+Caligari) (2011). An Introduction to Plant Breeding ISBN: 978-1-444-35770-7, 244 p.  **Recommended reading:**  D. P. Singh A. K. Singh A. Singh (2021). Plant Breeding and Cultivar Development1st Edition  ISBN: 9780128175637, p.662  George Acquaah (2020). Principles of Plant Genetics and Breeding, 3rd Edition. ISBN: 978-1-119-62632-9, p.848 |
| **Competencies to be acquired, related to the course:** |
| **a) Knowledge:**  - Students know in detail the current requirements of the knowledge and activity system of crop production, the main theories, the overall relations, the limitations of their application, and the terminology describing them.  **b) Ability:**  Students are able to apply complex, new methods and techniques and technologies that can be used in crop production.  They are able to identify special professional problems related to crop production, to explore and formulate the detailed theoretical and practical background needed to solve them.  **c) Attitude:**  Students are open to learn about and practicing modern and innovative crop production methods.  **d) Autonomy and responsibility:**  -Students have autonomy as to the way in which crop production activities are carried out.  They are able to manage independently, with an environmental approach, to apply and develop modern agricultural technologies related to crop production. |

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| **Course leader** (name, post, academic degree): **Dr. András Szabó assistant professor, PhD** |
| **Other lecturer(s) involved in teaching the course, if any** (name, post, academic degree): **-** |

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| Name of course: **Organic matter management in soil** | **Credit value: 3** |
| **Course** **classification**: optional | |
| **The proportion of the practical nature of the course, „educational character”: 50-50%** | |
| **Type of course: 14** theoretical / **14** practical, and the **total number: 28 hours** in the given **semester.**  Further (unique) means and properties of knowledge transfer: - | |
| **Exam** type (colloquium / practical grade / **other** ): practical grade  Further (unique) means of knowledge verification**: ­** | |
| The curricular **place of the course** (which semester): 2 | |
| Prerequisites (if any):  **­** | |

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| **Course description: a brief, but informative description of the knowledge to be acquired (14 weeks).** |
| Course objectives:  Knowledge of factors influencing the condition of soils. Factors affecting soil heat, water and air management. Relationship between tillage, soil improvement and soil structure. The effect of plant residues (straw, stems) on the development of soil life and the indirect nutrient supply of plants. Significance of barn fertilization and its effect on soil life, soil fertility. Professional requirements for barn fertilization. Manure treatment methods. Evaluation of different organic fertilizers.  Requirements and rules for the application of green manure and slurry. Factors influencing soil fertility. The role of organic matter in the development of the nutrient balance. The importance of organic farming in sustainable, developing crop production.  Thematic of subject  1. Climatic and edaphic endowment and evaluation and analysis of Hungary.  2. Mineral and organic nutrient content and most important characteristics of soils.  3. Factors influencing soil mineralization and humification. Types and characteristics of humus.  4. Impact of climate change on soil life and soil fertility.  5- Classification of organic matters in the soil and its characteristics. Their effect on the soil - plant relationship.  6. Effect of crop production on the soil structure and fertility.  7. Consequences of crop rotation, the effect of fixities on the soil.  8. The effect of crop rotation on changes in soil water and nutrient reserves.  9. Effect of by-products (stem, root) on soil organic matter stocks.  10. Expected amount of manure and their nutrient content in relation to livestock and technology.  11. Manure treatment methods and their major features.  12. Practical issues and requirements for barn fertilization.  13. Practice of green manure fertilization.  14. The impact of organic farming on sustainable, scalable crop production, soil life and long-term soil fertility. |
| **Required and recommended reading:** |
| **Required reading:**   * Loch J., Nosticzius Á. szerk. 2004. Agrokémia és növényvédelemi kémia. Mezőgazda Kiadó, Budapest. (ISBN: 963-286-053-5) 407. p. * Sárdi K. 2011. Tápanyaggazdálkodás. http://www.tankonyvtar.hu/hu/ * tartalom/tamop425/0010\_1A\_Book\_04\_Tapanyaggazdalkodas/ch06s02.html * Harald Kosegarten, Thomas Appel. 2012. Principles of Plant Nutrition. Springer Science & Business Media (ISBN: 9401010099) 849. p. * Horst Marschner: 2012. Marschner's Mineral Nutrition of Higher Plants. (ed.: Petra) Academic Press, (ISBN: 9780123849052) 651. p.   **Recommended reading:**   * Allen V. Barker, David J. Pilbeam: 2016. Handbook of Plant Nutrition. CRC Press. (ISBN: 9781420014877) 632 p. |
| **Competencies to be acquired, related to the course:** |
| **a) Knowledge:**  - Students know and understand the principles of protecting the natural environment, and know the environmental, nature protection, hygiene, food safety, food health and occupational safety regulations related to crop production.  - Knows the specific research methods and abstraction techniques of plant cultivation, the ways of elaborating the practical aspects of the theoretical issues.  **b) Ability:**  - Able to analyze the activities and practical problems of the nutrient management and crop production with scientific scientific methods.  - Able to express opinions in written and oral form and participate in discussions on issues related to plant production, nutrient supply and soil fertility hat a high level in Hungarian and in a foreign language.  **c) Attitude:**  - Recognizes values of nature and receptive to the use of crop production and fertilization methods and tools that have effective solutions to maintain the soil fertility.  **-** Student is open-minded, proactive, empathetic and thoughtful and subordinates his opinion to professional aspects.  **d) Autonomy and responsibility:**  - Student is equal partner in professional cooperation.  - Able to independent and environmental friendly crop production and nutrient supply, able to apply and develop modern agricultural technologies related to crop production and fertilization. |

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| **Course leader** (name, post, academic degree): **Dr. Éva Babett Ábrahám assistant professor, PhD** |
| **Other lecturer(s) involved in teaching the course, if any** (name, post, academic degree): **-** |

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| Name of course: **Operation of agricultural machinery** | **Credit value: 3** |
| **Course** **classification**: **classification** | |
| **The proportion of the practical nature of the course, „educational character”: 50**/50 (credit%) | |
| **Type of course: 1** theoretical / 1 practical, and the **total number: 28 hours** in the given **semester.**  Further (unique) means and properties of knowledge transfer: | |
| **Exam** type (colloquium / practical grade / **other** ): colloquium  Further (unique) means of knowledge verification**:** | |
| The curricular **place of the course** (which semester): 1 | |
| Prerequisites (if any): **-** | |

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| **Course description: a brief, but informative description of the knowledge to be acquired (14 weeks). (9 for MSc graduates) weeks** |
| The general aim of teaching the subject:  In the course of this subject, students will learn about the main soil tillage machinery, the various types of seed drills, irrigation equipment, nutrient supply and crop protection machines, as well as the machines and their components for harvesting grain and root crops.  1. Operation of soil cultivation machinery I.  2. Operation of soil cultivation machinery II.  3. Operation of seed drills I.  4. Operation of seed drills II.  5. Operation of nutrient replenishment machines I.  6. Operation of nutrient replenishment machines II.  7. Operation of irrigation machinery I.  8. Operation of irrigation machinery II.  9. Operation of plant protection machinery I.  10. Operation of plant protection machinery II.  11. Harvesting machinery I. Operation of a combine harvester.  12. Harvesting machinery II Operation of maize harvesting machinery.  13. Operation of machines for harvesting fodder I.  14. Operation of machines for harvesting fodder II.  In the course of the course, students will acquire the knowledge necessary for the determination and adjustment of the operating parameters of the main soil cultivation machines, the various sowing machines, irrigation equipment, nutrient supply and plant protection machines, as well as machines for harvesting grain and root crops.  1. Operation of soil cultivation machinery I.  2. Operation of soil cultivation machinery II.  3. Operation of seed drills I.  4. Operation of seed drills II.  5. Operation of nutrient recovery machines I.  6. Operation of nutrient replenishment machines II.  7. Operation of irrigation machinery I.  8. Operation of irrigation machinery II.  9. Operation of plant protection machinery I.  10. Operation of plant protection machinery II.  11. Harvesting machinery I. Operation of a combine harvester.  12. Harvesting machinery II Operation of maize harvesting machinery.  13. Operation of machines for harvesting fodder I.  14. Operation of machines for the harvesting of fodder II |
| **Required and recommended reading:** |
| **Required reading:**  1. Szendrő Péter (ed.): Mezőgazdasági géptan ISBN 9639121177  2. Szendrő Péter (ed.): Példák mezőgazdasági géptanból ISBN 9633562066  **Recommended reading:**  3. Brian Bell: Farm Machinery ISBN 1903366682  4. S Böttinger: Grundlagen der Landtechnik |
| **Competencies to be acquired, related to the course:** |
| **a) knowledge:**  Knowledge of the general and specific characteristics of the field, its boundaries, the main trends in its development and its links with related fields.  **b) ability:**  They takes a multifaceted, interdisciplinary approach to identifying specific professional problems, and explore and formulate the detailed theoretical and practical background needed to solve them.  **c) attitude:**  They strive to put the latest findings in the field at the service of their own development.  **d) autonomy and responsibility:**  Plan and carry out activities independently. |

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| **Course leader** (name, post, academic degree): **Dr. Zoltán Hagymássy, Associate Professor** |
| **Other lecturer(s) involved in teaching the course, if any** (name, post, academic degree): **Árpád Illés, assistant lecturer** |

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| Name of course: **Food chain safety** | **Credit value: 3** |
| **Course** **classification**: optional | |
| **The proportion of the practical nature of the course, „educational character”: 50/50** | |
| **Type of course:** theoretical / practical, and the **total number: 14/14 hours** in the given **semester.**  Further (unique) means and properties of knowledge transfer: | |
| **Exam** type (colloquium / practical grade / **other** ):  **practical grade**  Further (unique) means of knowledge verification**:** | |
| The curricular **place of the course** (which semester): 3 | |
| Prerequisites (if any): **-** | |

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| **Course description: a brief, but informative description of the knowledge to be acquired (14 weeks).** |
| The main aim of the lectures and practices is to know the physical, chemical and biological/microbiological hazards which have important effects on food chain safety. In this semester, students will learn the methodology of risk analysis (mainly the risk assessment) and the methodology of the determination of safe human dose, tolerable intakes and other toxicological values. Student will learn the methodology of hazard analysis and preparation of HACCP plans.   1. Food quality 2. Influencing factors of food chain safety 3. Microbiological hazards in foods 4. Chemical hazards in foods 5. Introduction to toxicology 6. Human exposure assessment 7. Introduction to risk analysis 8. Preliminary risk management activities 9. Chemical risk assessment 10. Risk management and risk communication 11. Methodology of HACCP handbook 12. Hazard analysis of plant origin food production 13. Hazard analysis of animal origin food production 14. Food labelling 15. Geographical indicators and trademarks |
| **Required and recommended reading:** |
| **Required reading:**  FAO FOOD AND NUTRITION PAPER 87 (2009): Food safety risk analysis. A guide for national food safety authorities. ISBN: 978 92 5 105604 2  WHO (2004): Risk Assessment Terminology. ISBN: 92 4 156267 6  US EPA (2019): Guidelines for human exposure assessment. (<https://www.epa.gov/sites/production/files/2020-01/documents/guidelines_for_human_exposure_assessment_final2019.pdf>)  **Recommended reading:**  WHO (2009): Pribciples and methods for the risk assessment of chemicals in food. ISBN: 978 92 4 157240 8  EFSA (2015): Manual for reporting on foodborne outbreaks in accordance with Directive 2003/99/EC for information derivingfrom the year 2014. (http://onlinelibrary.wiley.com/doi/10.2903/sp.efsa.2015.EN-770/pdf) |
| **Competencies to be acquired, related to the course:** |
| **a) Knowledge:**  - Students will gain the knowledge and skills required for human exposure assessment, risk assessment and risk management  - Students will gain the knowledge and skills required for hazard and risk assessment related to plant and animal origin foods  **b) Ability:**  - Students will be able to apply the tools of risk assessment  - Students will be able to characterise hazards and determine risks related to food safety  **c) Attitude:**  - Students will be endeavoured to apply the newest scientific results  **d) Autonomy and responsibility:**  - Students shall be able to feel responsible for safe food production |

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| **Course leader** (name, post, academic degree): **Dr. Nikolett Czipa, associate professor, PhD** |
| **Other lecturer(s) involved in teaching the course, if any** (name, post, academic degree): **Loránd Alexa, assistant lecturer** |

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| Name of course: **Crop production in EU** | **Credit value: 3** |
| **Course** **classification**: optional | |
| **The proportion of the practical nature of the course, „educational character”: 50/50 (credit%)** | |
| **Type of course:** 14theoretical / 14 practical, and the **total number: 28 hours** in the given **semester.**  Further (unique) means and properties of knowledge transfer: - | |
| **Exam** type (colloquium / practical grade / **other** ):  **colloquium**  Further (unique) means of knowledge verification**:** | |
| The curricular **place of the course** (which semester): **semester 1** | |
| Prerequisites (if any): **-** | |

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| **Course description: a brief, but informative description of the knowledge to be acquired (14 weeks).** |
| The objectives of the course are to give information about the ecological and economical characteristics of crop production in European Union. Importance of Common Agricultural Policy (CAP). Rural development as part of the agricultural policy.  The Maastricht Treaty, the foundation treaty of the European Union (EU). The Treaty of Rome, or EEC Treaty: the treaty establishing the European Economic Community. The General Agreement on Tariffs and Trade (GATT): Agreement on Agriculture, import restrictions. The agricultural quota system. WTO (World Trade Organization). Agricultural export subsidy in Hungary. Effect of the European agricultural guarantee fund (EAGF) and the European Agricultural Fund for Rural Development (EAFRD) on the compatibility of agricultural sector. The role of Common Market Organisation (CMO) in the regulation of the agricultural markets in the European Union (EU). System of animal and plant health regulations Status of major crop production sectors in EU.  Schedule of the Course (14 weeks):   1. History of crop production in Europe. 2. Ecological and economical characteristics of crop production in EU. 3. Institutionalization and regulation of crop production, in EU. 4. Agricultural policy and organizations in EU. 5. Characteristics and ways of organic production in EU. 6. Cereal production in EU. 7. Leguminous crops production in EU. 8. Oil crops production in EU. 9. Roots and tuber crops production in EU. 10. Other industrial crops production in EU. 11. Medicinal and aromatic plants production in EU. 12. Seed production in EU. 13. Nutrient management in field crop production in EU. 14. Water management in field crop production in EU. |
| **Required and recommended reading:** |
| **Required reading:**  Joseph A. McMahon: EU Agricultural Law and Policy. Elgar European Law series. Edward Elgar Publishing Limited. Cheltenham, UK 2019. ISBN: 978 1 78100 254 4  Floor Brouwer (edited): Nature and Agriculture in the European Union. New Perspectives on Policies that Shape the European Countryside Edward Elgar Publishing Limited. Cheltenham, UK 2002. ISBN: 978 1 84064 235 3  David Lea (Ed.): Agricultural and Mineral Commodities Year Book. Europa Publications, Taylor & Francis Group. London. 2002. ISBN: 1-85743-150-2.  **Recommended reading:**  Maurice Eddowes: Crop Production in Europe. Oxford University. 1977. ISBN-13: 978-0198594604. |
| **Competencies to be acquired, related to the course:** |
| **a) Knowledge:**   * Students will be able to proactively learn new skills and develop self for present and future progression * Students are capable to do adequate professional communication; can participate in the seed production process directly or support it * Students actively and operatively can attend to implementation of R&D projects   **b) Ability:**   * Students can understand and observe the law, protocols and regulations connecting to crop production * Able to work according to environmental regulations and health regulations   **c) Attitude:**   * Constructive approach to the professional questions * Health of the individual and society beside of environmental protection plays an important part in the professional decisions * Open to new technologies   **d) Autonomy and responsibility:**   * Students are able to bear the responsibility of the decisions and responsible for own and the attached workforce’s work * Students are decisive at the right time * Based on the professional knowledge students can set up the implementation plan of R&D projects independently, and bear the responsibility of direct managing of the development activity |

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| **Course leader** (name, post, academic degree): **Dr. Erika Tünde Kutasy PhD, assistant professor** |
| **Other lecturer(s) involved in teaching the course, if any** (name, post, academic degree): **-** |

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| Name of course: **Seed production** | **Credit value: 3** |
| **Course** **classification**: optional | |
| **The proportion of the practical nature of the course, „educational character”: 50/50 (credit%)** | |
| **Type of course:** 14theoretical / 14 practical, and the **total number: 28 hours** in the given **semester.**  Further (unique) means and properties of knowledge transfer: - | |
| **Exam** type (colloquium / practical grade / **other** ):  **colloquium**  Further (unique) means of knowledge verification**:** | |
| The curricular **place of the course** (which semester): **semester 3** | |
| Prerequisites (if any): **-** | |

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| **Course description: a brief, but informative description of the knowledge to be acquired (14 weeks).** |
| The objectives of the course are to give information about the Hungarian and international seed production and all of its aspects. The European seed sector plays a key role to meet global challenges: mitigating climate change, feeding a growing world population and supporting resource-efficient farming systems. A constant stream of innovative quality seeds is essential to contribute to a sustainable agricultural production that fosters food security and healthy nutrition.  Seed production course deals with the agroecological, biological-genetic and agrotechnical factors of seed crop production. General and special elements in seed production. Ecological, biological and agrotechnical circumstances of seed crop management. The regulation of the Hungarian and European seed sector, parts of the plant breeding, seed production and marketing chain, the institutionalization and regulation of seed production, breeding and distribution. The international organizations of seed certification agencies.  Schedule of the Course (14 weeks):   1. Development of seed production. The formation of government control over seed production and seed processing. The national and international state of seed production, the major sectors of seed production. The regulation of the Hungarian and European seed sector, implementation of EU legislation. 2. Aspects of European and Hungarian seed industry, including research, plant breeding, seed production and marketing chain. 3. The national and European institutionalization and regulation of seed production, breeding and distribution. National and European seed certification agencies, national seed certification systems, 4. Seed trade of Hungary and the EU. 5. The Hungarian system of seed production and distribution 6. Seed production: field inspection and sealing 7. The Propagation Stages and Notation of Sowing Seed 8. Seed sample and seed analysis. Tagging and sealing of seeds. 9. Drying and Storage of Sowing Seed, Seed Cleaning, Seed Dressing Methods. 10. Seed production of winter wheat and other cereals. 11. Hybrid seed corn production. 12. Sunflower seed production. 13. Sugarbeet seed production 14. Alfalfa seed production. |
| **Required and recommended reading:** |
| **Required reading:**  International Rules for Seed Testing Volume 2016 International Seed Testing Association Number 1, 1 January 2016, pp. i-284(284) ISSN 2310-3655  **Recommended reading:**  Babasaheb B. Desai (2004): Seeds Handbook: Biology, Production, Processing, and Storage CRC Press; 2nd edition 800 pp ISBN 978-0824748005  Copeland-McDonald (2001): Principles of Seed Science and Technology. 4th Edition, Kluwer Academic Publishers ISBN 978-0792373223 |
| **Competencies to be acquired, related to the course:** |
| **a) Knowledge:**   * Basic knowledge of natural, technical, economic sciences, technologies, food-chain security giving the basis for seed production * Acquired knowledge to up-to date technologies used in seed production and their practical application * Students will be able to proactively learn new skills and develop self for present and future progression * Students are capable to do adequate professional communication; can participate in the seed production process directly or support it * Students actively and operatively can attend to implementation of R&D projects   **b) Ability:**   * Ability in recognizing and solving the routine like problems occurring in seed production processes * Students can understand and observe the law, protocols and regulations connecting to seed production * Able to work according to environmental regulations and health regulations   **c) Attitude:**   * Main feature is the constructive approach to the professional questions * Students look for ways to change work methods to improve performance * Health of the individual and society beside of environmental protection plays an important part in the professional decisions * Open to new technologies   **d) Autonomy and responsibility:**   * Students are able to bear the responsibility of the decisions and responsible for own and the attached workforce’s work * Students are decisive at the right time * Based on the professional knowledge students can set up the implementation plan of R&D projects independently, and bear the responsibility of direct managing of the development activity |

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| **Course leader** (name, post, academic degree): **Dr. Erika Tünde Kutasy PhD, assistant professor** |
| **Other lecturer(s) involved in teaching the course, if any** (name, post, academic degree): **-** |

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| Name of course: **Agroecological systems** | **Credit value: 3** |
| **Course** **classification**: optional | |
| **The proportion of the practical nature of the course, „educational character”: 50-50%.** | |
| **Type of course:** theoretical / practical, and the **total number: 1+1 hours** in the given **semester.**  Further (unique) means and properties of knowledge transfer: | |
| **Exam** type (colloquium / practical grade / **other** ):  **colloquium**  Further (unique) means of knowledge verification**:** | |
| The curricular **place of the course** (which semester): 1 | |
| Prerequisites (if any): **-** | |

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| **Course description: a brief, but informative description of the knowledge to be acquired (14 weeks).** |
| The aim of the course is to describe the structure of ecosystems, the interaction of individual elements, the elements of agricultural production habitat, the interactive relationship between agricultural production and environmental factors, the effects of climate change on agricultural production, the exploration of material and energy turnover in agroecological systems, principles of sustainable agriculture and possibilities of its implementation at different levels of cultivation technologies.  Subject topics:  Week 1: Structure of ecological systems, the importance of individual ecological elements in agriculture.  Week 2: Cycles in ecosystems, interactions between populations and their role in agricultural production.  Week 3: Stability and resilience of agro-ecosystems.  Week 4: The cycle of the elements in the crop space.  Week 5: Factors influencing the water supply, characteristics of soil water management, impact on the crop production area. Regularities and characteristic parameters of evaporation processes.  Week 6: The effect of tillage on the ecological parameters of the crop production area.  Week 7: Effects of crop rotation, species and variety use on the ecological parameters of the crop production area  Week 8: The effect of the nutrient supply system, the forms of fertilization on the ecological parameters of the crop production area.  Week 9: Effect of irrigation types on ecological parameters of crop production area.  Week 10: Interactions between different levels of cultivation technology models and crop production space .  Week 11: Types and characteristics of sustainable, environmentally friendly agrotechnical systems.  Week 12: The effects of climate change on agricultural production, the possibilities of adaptation.  Week 13: Opportunities to maintain and increase soil fertility.  Week 14: Preservation of the balance of agroecological systems, possibilities of its restoration. |
| **Required and recommended reading:** |
| **Required reading:**  Stephen R. Gliessman (2015). Agroecology - The Ecology of Sustainable Food Systems, Third Edition, ISBN 9781439895610, p. 406  Noureddine Benkeblia (2019). Agroecology, Ecosystems, and Sustainability  ISBN 9780367435981, p. 393  **Recommended reading:**  V. Ernesto Méndez, Christopher M. Bacon, Roseann Cohen, Stephen R. Gliessman (2016).  Agroecology - A Transdisciplinary, Participatory and Action-oriented Approach ISBN 9780367436018, p. 284    Stephen R. Gliessman - Eric Engles - Robin Krieger(1998). Agroecology: Ecological Processes in Sustainable Agriculture, ISBN 9781575040431 |
| **Competencies to be acquired, related to the course:** |
| **a) Knowledge:**  - Students know in detail the current requirements of the knowledge and activity system of crop production, the leading theories, the causal relations, the limitations of their application, and the terminology describing them.  **b) Ability:**  - Students are able to apply complex, new methods and techniques and technologies that can be used in crop production, just as they are able to identify special professional problems related to crop production, to explore and formulate the detailed theoretical and practical background needed to solve them.  **c) Attitude:**  - Students are open to learn about and practicing modern and innovative crop production methods.  **d) Autonomy and responsibility:**  -Students have autonomy as to the way in which crop production activities are carried out, they are able to manage independently, with an environmental-conscious approach, to apply and develop modern agricultural technologies related to crop production. |

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| **Course leader** (name, post, academic degree): **Dr. András Szabó assistant professor, PhD** |
| **Other lecturer(s) involved in teaching the course, if any** (name, post, academic degree): **-** |

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| Name of course: **Basics of Integrated Plant protection** | **Credit value: 3** |
| **Course** **classification**: elective | |
| **The proportion of the practical nature of the course, „educational character”:** | |
| **Type of course:** theoretical / practical, and the **total number: hours** in the given **semester. 1 th + 1 practical/week**  Further (unique) means and properties of knowledge transfer: | |
| **Exam** type (colloquium / practical grade / **other** ):  **colloquium**  Further (unique) means of knowledge verification**:** | |
| The curricular **place of the course** (which semester): II. | |
| Prerequisites (if any): **-** | |

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| **Course description: a brief, but informative description of the knowledge to be acquired (14 weeks).** |
| *Integrated plant protection*  Targets: To learn the most important principles of integrated plant- and fruit protection. To present the most important pests, pathogens snd weeds of the important plant cultures as well as to study the basic technologies (mechanical, agrotechnical, chemical, biological) against them.  1. Basic of integrated plant protection and plant protectional methods.  2. Plant protectional forecasting and epidemiology.  3. Basic of plant protectional forecasting.  4. Forecasting of weed species.  5. Forecasting of bacterial diseases.  6. Forecasting of plant pathogenic fungi.  7. Forecasting of insects.  8. Pestice management and quality control  9. Integrated plant protection in arable plant cultures.  10. Principles of ecological plant protection systems.  11. Integrated plant protection of vegetables.  12. Integrated plant protection of fruits and grape.  13. Integrated plant protection in greenhouses  14. Integrated plant protection and ecotoxicology |
| **Required and recommended reading:** |
| **Required reading: - Radosevich S. R.- Holt J. S.. (1994):** Weed Ecology and Vegetation Management. Wiley-Interscience publication, New York.  **-Glenn C. Klingman and Floyd M. Ashton (2004):** Weed Science (3rd edition). Wiley-Interscience Publication. New York.  **- Diseases of Fruits and Vegetables - Diagnosis and Management** Edited by S Naqvi Springer  2004  **Recommended reading:**  - **General Concepts in Integrated Pest and Disease Management** Edited by A Ciancio and K G Mukerji  Springer  2007 |
| **Competencies to be acquired, related to the course:** |
| **a) Knowledge:**  - - Student will learn the scientific, technical, technological, basic concepts of food chain safety, management.  **b) Ability:**  - Students will know the interaction between the environment and agricultural production and will be able to make decision with a complex approach in work.  **c) Attitude:**  - Their work is characterized by high standard.  - They will be able to stand up for their views, but are open to others’ opinions as well.  **d) Autonomy and responsibility:**  - They will be able to recognize the risks and boundaries of their decisions.  - They will have an independent sense of professional responsibility. |
| **Course leader** (name, post, academic degree): **Dr. habil Laszló Radócz associate professor, CSc** |
| **Other lecturer(s) involved in teaching the course, if any** (name, post, academic degree): **-** |

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| Name of course:Fundamentals of eco-physiology for more efficient plant production | **Credit value: 3** |
| **Course** **classification**: optional | |
| **The proportion of the practical nature of the course, „educational character”: 100% lecture** | |
| **Type of course:** theoretical / practical, and the **total number: hours** in the given **semester.**  Further (unique) means and properties of knowledge transfer: 28 lectures per semester | |
| **Exam** type (colloquium / practical grade / **other** ):  Further (unique) means of knowledge verification**:** | |
| The curricular **place of the course** (which semester): preferable 2nd semester or later | |
| Prerequisites (if any): **-** | |
| **Course description: a brief, but informative description of the knowledge to be acquired (14 weeks).** | |
| Objective: to focus on how environmental impacts affect plant productivity and survival in natural associations and farming systems.   1. Grouping of environmental factors, their general characterization. What do plants need from their environment at all, how can they get it, what can they do to achieve it? Natural and anthropogenic changes in environmental factors and possibilities of plant responses. Interpretation of basic concepts: load, stress, adaptation, acclimatization, etc. 2. Light as an environmental factor I .: Light as the most important environmental factor for plants. Photoreceptors: structure and function relationship. Adaptation mechanisms of light as a limiting factor in shade-tolerant plants. 3. Light as an environmental factor II .: Interpretation of light as excess light, photoinhibition and photooxidation, description of adaptation and acclimatization processes against light damage. Physiological consequences of UV light. 4. Relationships between environmental factors and different photosynthetic pathways (C3, C4, CAM). Changes and consequences of the C-balance sheet. Effects of elevated CO2 levels on photosynthesis, growth, biological and economic yields. 5. Plant water circulation, water availability and different adaptation mechanisms in plants with different adaptations. Poikilohydric and homoiohydric plants. 6. Water as an environmental factor: water status of the plant, water stress. Stoma conductance and regulation. Relationships between transpiration and photosynthesis. 7. Physiological basis of drought tolerance. 8. The role of soil condition in plant growth. Possibility of plants on contaminated soils, saline soils, survival strategies of natural plant associations. 9. Temperature as an environmental factor: the effect of high and low temperature on plants. Opportunities for crop production in the tropics. Cold and frost damages. 10. Nutrient as an environmental factor I .: the issue of nutrient availability, the nutrient turnover of the soil-microorganism-plant-atmosphere. 11. Nutrient as an environmental factor II .: Nitrogen uptake and metabolism. Possibilities of organic/bio fertilization for different crops and soil types. 12. Nutrient as an environmental factor III .: mycorrhiza-plant relationship system. The role of microelements in crop production. 13. Possible effects of air, its composition, air pollutants on plants. Effects of acid rain, dust, soot and flue gases. 14. Field and laboratory methods to characterize the condition of plants. Principle of operation of diagnostic instruments for *in vivo* and *in situ* use by agricultural crop production. | |
| **Required and recommended reading:** | |
| **Required reading:**  Lambers, H., Chapin, F. S. and Pons, T. L. (2011) Plant Physiological Ecology. Springer, New York. ISBN 0-387-98326-0  **Recommended reading:**  Taiz, L., Zeiger, E. (2007) Plant Physiology. 4th ed. Sinauer Associates, Inc. ISBN 0-87893-823-0 or online version  The newest review scientific articles connected to the current sub-topics. | |
| **Competencies to be acquired, related to the course:** | |
| **a) Knowledge:**   * complex knowledge about processes of plant physiology * interaction between physiological processes and environment * how can the abiotic environment controll and influence these processes   **b) Ability:**   * critical thinking * problem solving   **c) Attitude:**   * to be motivated to work hard and always try to find connections between the individual and the environment   **d) Autonomy and responsibility:**   * in data discussion/presetation/evaluation | |
| **Course leader** (name, post, academic degree): **Dr. Szilvia Veres, professor, PhD** | |
| **Other lecturer(s) involved in teaching the course, if any** (name, post, academic degree): **-** | |

**Internship requirements**

The internship is an internship lasting at least four weeks as defined in the training curriculum. The internship course must be signed up for previously via the NEPTUN study registration system in the fall semester (3rd semester). The placement has to be approved by the course leader before the commencement of the internship.

# **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 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 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 the 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 the program the credits assigned to the thesis is 30.

The thesis topics are announced by the departments for the students. 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 the graduate program. The diploma contains the following data: name of HEI (higher education institution); institutional identification number; serial number of diploma; name of diploma holder; date and place of his/her birth; level of qualification; training program; specialization; mode of attendance; place, day, month and year issued. Furthermore, it has to contain the dean’s (or vice-dean’s) original signature and the seal of HEI. It has to contain the dean’s (in case of being prevented from attending the vice- dean for educational affairs) original signature and the imprint of the official stamp of the tertiary institute.

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

Calculation of a diploma grade according to this formula:

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

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

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

On the basis of the calculated average grade the classification of the award: 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.

**MODEL CURRICULUM OF CROP PRODUCTION 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/crop-production-engineering-msc

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| *Head: Dr. József Csajbók associate professor, PhD* | |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | **March, 2022** |
| **Tárgykód** | **Title of the subject** | 1st semester | | | | 2nd semester | | | | 3rd semester | | | | 4th semester | | | | **Head of Subject** |
| 14 week | | | | 14 week | | | | 14 week | | | | 14 week | | | |
| lecture | practice | evaluation | credit | lecture | practice | evaluation | credit | lecture | practice | evaluation | credit | lecture | practice | evaluation | credit |
| ***Basic sciences and engineering*** | | | | | | | | | | | | | | | | | | |
| MTMNT7001 | Physiology of cultivated plants | 2 | 2 | E | 3 |  |  |  |  |  |  |  |  |  |  |  |  | Dr. Szilvia Veres |
| MTMNT7002 | Organic and biochemitry | 2 | 2 | E | 3 |  |  |  |  |  |  |  |  |  |  |  |  | Rita Erdeiné Dr. Kremper |
| MTMNT7003 | Applied Soil Science | 2 | 2 | E | 3 |  |  |  |  |  |  |  |  |  |  |  |  | Dr. Mária Csubák |
| MTMNT7004 | Agricultural informatics | 1 | 2 | P | 3 |  |  |  |  |  |  |  |  |  |  |  |  | Dr. László Várallyai |
| MTMNT7005 | Agricultural microbiology | 1 | 1 | E | 3 |  |  |  |  |  |  |  |  |  |  |  |  | Dr. Erzsébet Karaffa |
| MTMNT7006 | Genetics of cultivated plant | 1 | 1 | P | 3 |  |  |  |  |  |  |  |  |  |  |  |  | Dr. Erika Kurucz |
| MTMNT7007 | Adaptive Tillage | 2 | 1 | P | 3 |  |  |  |  |  |  |  |  |  |  |  |  | Dr. Adrienn Kakuszi-Széles |
| ***Sum total*** | | **11** | **11** | **21** | |  |  |  |  |  |  |  |  |  |  |  |  |  |
| ***Conpulsory professional care curriculum*** | | | | | | | | | | | | | | | | | |  |
| MTMNT7008 | Crop production I. |  |  |  |  |  |  |  |  | 2 | 2 | E | 4 |  |  |  |  | Dr. Péter Pepó |
| MTMNT7009 | Crop Production II. |  |  |  |  |  |  |  |  |  |  |  |  | 2 | 2 | E | 3 | Dr. József Csajbók |
| MTMNT7010 | Plant biotechnology |  |  |  |  | 1 | 1 | P | 3 |  |  |  |  |  |  |  |  | Éva Domokosné Dr. Szabolcsy |
| MTMNT7011 | Diseases of cropland plants |  |  |  |  | 1 | 1 | E | 3 |  |  |  |  |  |  |  |  | Dr. Gábor Tarcali |
| MTMNT7012 | Animal pests of crops |  |  |  |  | 1 | 1 | E | 3 |  |  |  |  |  |  |  |  | Dr. Antal Nagy |
| MTMNT7013 | Weed control |  |  |  |  | 1 | 1 | E | 3 |  |  |  |  |  |  |  |  | Arnold Szilágyi |
| MTMNT7014 | Crop production economics |  |  |  |  |  |  |  |  |  |  |  |  | 2 | 2 | E | 3 | Dr. Beáta Bittner |
| MTMNT7015 | Introduction to EU Law |  |  |  |  |  |  |  |  |  |  |  |  | 1 | 1 | P | 3 | Dr. Ágnes Bujdos |
| MTMNT7016 | Precision farming |  |  |  |  |  |  |  |  |  |  |  |  | 2 | 1 | E | 3 | Dr. Péter Pepó |
| ***Sum total*** | |  |  |  |  | **4** | **4** | **12** | | **2** | **2** | **4** | | **7** | **6** | **12** | |  |
| MTMNT7GY | Internship |  |  |  |  | 0 | 160 | P | 2 |  |  |  |  |  |  |  |  | Dr. József Csajbók |
| SI-001 | Physical excercise |  |  |  |  | 0 | 2 | A | 0 |  |  |  |  |  |  |  |  |  |
|  | Agrochemistry |  |  |  |  | 2 | 1 | E | 3 |  |  |  |  |  |  |  |  | Andrea Balláné Dr. Kovács |
| MTMNT7018 | Plant breeding and transgenic plants |  |  |  |  |  |  |  |  | 1 | 1 | E | 3 |  |  |  |  | Dr. Erika Kurucz |
| MTMNT7019 | Land classification and regional development |  |  |  |  |  |  |  |  | 1 | 1 | P | 3 |  |  |  |  | Dr. Adrienn Kakuszi-Széles |
| MTMNT7020 | Quality control of field crops |  |  |  |  | 1 | 1 | P | 3 |  |  |  |  |  |  |  |  | Dr. Diána Ungai |
| MTMNT7021 | Quality assurance in field crops |  |  |  |  |  |  |  |  |  |  |  |  | 2 | 0 | P | 3 | Dr. Ferenc Peles |
| MTMNT7022 | Mechanization of crop production |  |  |  |  |  |  |  |  | 2 | 2 | E | 3 |  |  |  |  | Dr. Zoltán Hagymássy |
| MTMNT7023 | Nutrient supply of field crops |  |  |  |  |  |  |  |  | 1 | 1 | P | 3 |  |  |  |  | Dr. Lajos Fülöp Dóka |
| MTMNT7024 | Irrigated crop production |  |  |  |  |  |  |  |  | 2 | 1 | E | 3 |  |  |  |  | Dr. József Csajbók |
| MTMNT7025 | Research methodology and extension |  |  |  |  |  |  |  |  |  |  |  |  | 1 | 1 | E | 3 | Dr. József Csajbók |
| ***Sum total*** | | **0** | **0** | **0** | | **3** | **4** | **6** | | **7** | **6** | **15** | | **3** | **1** | **6** | |  |
| ***Total number of hours:*** | | **11** | **11** | **21** | | **7** | **8** | **18** | | **9** | **8** | **19** | | **10** | **7** | **18** | |  |
| ***Facultative subjects (select minimum 6 credits)*** | | | | | | | | | | | | | | | | | |  |
| MTMNT7026 | Grassland management |  |  |  |  |  |  |  |  | 1 | 1 | P | 3 |  |  |  |  | Dr .Géza Nagy |
| MTMNT7028 | Communication |  |  |  |  |  |  |  |  |  |  |  |  | 1 | 1 | P | 3 | Dr. Csilla Juhász |
| MTMNT7029 | Organic crop production |  |  |  |  |  |  |  |  |  |  |  |  | 1 | 1 | E | 3 | Dr. András Szabó |
| MTMNT7031 | Cultivation of medicinal plants |  |  |  |  |  |  |  |  | 1 | 1 | P | 3 |  |  |  |  | Dr. Éva Babett Ábrahám |
| MTMNT7032 | Energy plant cultivation |  |  |  |  |  |  |  |  | 1 | 1 | P | 3 |  |  |  |  | Dr. Erika Kurucz |
| MTMNT7033 | Biological bases, variety use |  |  |  |  | 1 | 1 | E | 3 |  |  |  |  |  |  |  |  | Dr. András Szabó |
| MTMNT7034 | Organic matter management in soil |  |  |  |  | 1 | 1 | P | 3 |  |  |  |  |  |  |  |  | Dr. Éva Babett Ábrahám |
| MTMNT7035 | Operation of agricultural machinery | 1 | 1 | E | 3 |  |  |  |  |  |  |  |  |  |  |  |  | Dr. Zoltán Hagymássy |
| MTMNT7038 | Food chain safety |  |  |  |  |  |  |  |  | 1 | 1 | P | 3 |  |  |  |  | Dr. Nikolett Czipa |
| MTMNT7041 | Crop production in EU | 1 | 1 | E | 3 |  |  |  |  |  |  |  |  |  |  |  |  | Dr. Erika Kutasy |
| MTMNT7042 | Seed production |  |  |  |  |  |  |  |  | 1 | 1 | E | 3 |  |  |  |  | Dr. Erika Kutasy |
| MTMNT7043 | Agroecological systems | 1 | 1 | E | 3 |  |  |  |  |  |  |  |  |  |  |  |  | Dr. András Szabó |
| MTMNT7044 | Basics of Integrated Plant protection |  |  |  |  | 1 | 1 | E | 3 |  |  |  |  |  |  |  |  | Dr. László Radócz |
| MTMNT7045 | Fundamentals of eco-physiology for more efficient plant production |  |  |  |  | 2 | 0 | E | 3 |  |  |  |  |  |  |  |  | Dr. Szilvia Veres |
| ***Professional language group (select minimum 6 credits)*** | |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| MTM7NY1 | Academic Language Skills | 0 | 2 | P | 3 |  |  |  |  |  |  |  |  |  |  |  |  | Dr. Mária Czellér |
| MTM7NY2 | Professional language skills |  |  |  |  | 0 | 2 | P | 3 |  |  |  |  |  |  |  |  | Dr. Troy Wiwczaroski |
| ***Thesis preparation*** | | | | | | | | | | | | | | | | | |  |
| MTMNT7D1 | Thesis preparation I |  |  |  |  | 0 | 5 | P | 5 |  |  |  |  |  |  |  |  |  |
| MTMNT7D2 | Thesis preparation II |  |  |  |  |  |  |  |  | 0 | 10 | P | 10 |  |  |  |  |  |
| MTMNT7D3 | Thesis preparation III |  |  |  |  |  |  |  |  |  |  |  |  | 0 | 10 | P | 15 |  |
|  | ***Total number of hours:*** |  |  |  |  | **0** | **5** | **5** | | **0** | **10** | **10** | | **0** | **10** | **15** | |  |
|  | *Total number of credits for compulsory subjects* | 21 | | | | 20 | | | | 19 | | | | 18 | | | | 78 |
|  | *Total number of credits for subjects of free choise* | 3 | | | |  | | | | 3 | | | |  | | | | 6 |
|  | *Professional practice (4 weeks)* | 3 | | | | 3 | | | |  | | | |  | | | | 6 |
|  | Thesis |  | | | | 5 | | | | 10 | | | | 15 | | | | 30 |
|  | Total credit: | 27 | | | | 28 | | | | 32 | | | | 33 | | | | 120 |
|  | Total number of hours altogether (hour/week): | 322 | | | | 308 | | | | 322 | | | | 308 | | | | 1260 |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
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|  | E = Oral examination |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | E = Written examination |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | P = Practical examination |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | A = Acceptance |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |