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

Food Engineering BSc Program

2023

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

DEAN’S OFFICE…………..…………………………………………………………………………………….…9

INTSTITUTIONS AND [DEPARTMENTS OF FACULTY OF AGRICULTURAL](#_bookmark3) AND FOOD SCIENCES AND ENVIRONMENTAL MANAGEMENT……………………………………………..10

[ACADEMIC CALENDAR 2](#_bookmark4)3

[Information about the Program… 2](#_bookmark6)4

[Course Descriptions](#_bookmark8) 25

[Internship](#_bookmark10) 100

[Thesis](#_bookmark14) 102

[Final examination (Final Exam)](#_bookmark15) 103

Diploma……………………………………………………………………………………………………104

Curriculum………………………………………………………………………………………………..105

**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 bio-economy model, which is based on the recycling of materials and values, by increasing the added value of the produced product, through services and smart solutions. In the ranking of agricultural and higher education institutions in the world, Debrecen is always in the most prominent place, currently it is among the best between 150-200.

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

Dr. László Stündl

associate professor

dean

**HISTORY OF THE UNIVERSITY**

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

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

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

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

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

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

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

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

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

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

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

**HISTORY OF THE FACULTY**

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

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

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

# **ADMINISTRATION UNITS FOR INTERNATIONAL PROGRAMMES**

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

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

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

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

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

Agricultural Genomics and Biotechnology Center, Animal Genomics Research Team

Department of Animal Nutrition and Food Biotechnology

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

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

Department of Applied Plant Biology

Department of Crop Production, Applied Ecology and Plant Breeding

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

**Institute of Food Technology**

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

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

Department of Agricultural Engineering and Robotics

Department of Land Use

Department of Precision Technology

**Institute of Nutrition**

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

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

**Agricultural Laboratory Center**

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# [**INSTITUTE FOR LAND USE, ENGINEERING AND PRECISION**](http://www.agr.unideb.hu/etk/xsearch.php?optLang=en&lstDep=22203) **FARMING TECHNOLOGY**

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# **Department of Land Use**

# **Department of Precision Technology**

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| Ms. Zsuzsanna DorogiAdministrative Assistant | dorogizs@agr.unideb.huroom 11, building E |

**INSTITUTE OF NUTRITION**

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

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

#  **INSTITUTE OF PLANT PROTECTION**

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

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

**AGRICULTURAL LABORATORY CENTRE**

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

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

**INSTITUTE OF WATER AND ENVIRONMENTAL MANAGEMENT**

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

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| **name, position** | **e-mail, room number** |
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| Dr Nikolett SzőllősiAssistant Professor | nszollosi@agr.unideb.hu room 22, building N |
| Dr Lajos BlaskóProfessor Emeritus | blasko@agr.unideb.hu room 11, building N |
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| Dr. Edit GorliczayAssistant Professor | edit.gorliczay@agr.unideb.huroom 21, building N |
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**ACADEMIC CALENDAR**

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

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

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

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

# **THE FOOD ENGINEERING UNDERGRADUATE PROGRAM**

INTRODUCTION OF THE PROGRAM

|  |  |
| --- | --- |
| Name of graduate program: | Food Engineering Undergraduate Program |
| Level: | BSc |
| Qualification: | Food Engineer |
| Mode of attendance: | Full-time |
| Faculty: | Faculty of Agricultural and Food Sciences and Environmental Management |
| Program coordinator: | Péter Sipos, Professor |
| Program length: | 7 semesters |
| Credits total: | 210 credits |

The BSc in Food Engineering is aimed at training professionals who are able to operate, supervise and develop food processing technologies. The studies contain the physical, chemical and biological basics of engineering with special emphasis on the food quality and safety related issues.  Besides becoming acquainted with the operations and technological processes the students also learn economic, management and analytical aspects of food chain management. Therefore, the main goal of the education is to train people who are able to fully provide the functions in relation with the everyday tasks of operation from the engineering, biological and chemical work to the management duties based on their comprehensive theoretical bases. The 7 semesters include one semester long industrial practice period. Learning is through lectures, tutorials, seminar groups, practical sessions, research projects and self-directed study. Assessment is via oral and written examinations and a research dissertation.

**Lecture, seminar:** 40%

**Practice:** 60%

 **Internship, practice:** Students should complete a 14-week professional practice in the last semester.

**Career prospects:** Graduates may find employment in the food industry, raw material and product qualification, food analysis, inspection, quality assurance or may work for food authorities. Graduates may continue their studies with an MSc in food engineering, an MSc in food quality and assurance, or an MSc in nutrition.

**COURSE DESCRIPTIONS FOR FOOD ENGINEERING BSC**

The order of subjects in alphabetical order.

[Analytical Chemistry, MTBE7009](file:///%5C%5Cdunkelzahn.agr.unideb.hu%5Csites%5Cdefault%5Cfiles%5Cupload_documents%5Canalytical_chemistry_mtbe7009.docx)

[Animal Physiology, MTBE7005BA](file:///%5C%5Cdunkelzahn.agr.unideb.hu%5Csites%5Cdefault%5Cfiles%5Cupload_documents%5Canimal_physiology_mtbe7005a.docx)

[Baking and Pasta Technology, MTBE7035A](file:///%5C%5Cdunkelzahn.agr.unideb.hu%5Csites%5Cdefault%5Cfiles%5Cupload_documents%5Cbaking_and_pasta_technology_mtbe7035a.docx)

Basic Food Engineering Skills MTBE7044A

[Basic Principles of Food Mechanics, MTBE7011A](file:///%5C%5Cdunkelzahn.agr.unideb.hu%5Csites%5Cdefault%5Cfiles%5Cupload_documents%5Cbasic_principles_of_food_mechanics_mtbe7011a.docx)

[Basics of Quality Management, MTBE7010A](file:///%5C%5Cdunkelzahn.agr.unideb.hu%5Csites%5Cdefault%5Cfiles%5Cupload_documents%5Cbasics_of_quality_management_mtbe7010a.docx)

[Biochemistry, MTBE7007A](file:///%5C%5Cdunkelzahn.agr.unideb.hu%5Csites%5Cdefault%5Cfiles%5Cupload_documents%5Cbiochemistry_mtbe7007a.docx)

Chemometry, MTB7043A

[Dairy Industry Technology MTBE7027A](file:///%5C%5Cdunkelzahn.agr.unideb.hu%5Csites%5Cdefault%5Cfiles%5Cupload_documents%5Cdairy_industry_technology_mtbe7027a.docx)

[Economic Sciences I., MTB7020\_AA](file:///%5C%5Cdunkelzahn.agr.unideb.hu%5Csites%5Cdefault%5Cfiles%5Cupload_documents%5Ceconomic_sciences_i._mtb7020a.docx) and MTB7020\_BA

[Economic Sciences II. MTBE7024\_AA](file:///%5C%5Cdunkelzahn.agr.unideb.hu%5Csites%5Cdefault%5Cfiles%5Cupload_documents%5Ceconomic_sciences_ii._mtbe7024a.docx) and MTBE7024\_BA

[Economic Sciences III. MTB7026\_AA](file:///%5C%5Cdunkelzahn.agr.unideb.hu%5Csites%5Cdefault%5Cfiles%5Cupload_documents%5Ceconomic_sciences_iii._mtb7026a.docx) and MTB7026\_BA

[Electrotechnics MTBE7006BA](file:///%5C%5Cdunkelzahn.agr.unideb.hu%5Csites%5Cdefault%5Cfiles%5Cupload_documents%5Celectrotechnics_mtbe7006a.docx)

[Environmental Management MTB7015A](file:///%5C%5Cdunkelzahn.agr.unideb.hu%5Csites%5Cdefault%5Cfiles%5Cupload_documents%5Cenvironmental_management_mtb7015a.docx)

[Food Analytics MTBE7023A](file:///%5C%5Cdunkelzahn.agr.unideb.hu%5Csites%5Cdefault%5Cfiles%5Cupload_documents%5Cfood_analytics_mtbe7023a.docx)

[Food Chemistry, MTBE7014A](file:///%5C%5Cdunkelzahn.agr.unideb.hu%5Csites%5Cdefault%5Cfiles%5Cupload_documents%5Cfood_chemistry_mtbe7014a.docx)

[Food Colloidics MTBE7012](file:///%5C%5Cdunkelzahn.agr.unideb.hu%5Csites%5Cdefault%5Cfiles%5Cupload_documents%5Cfood_colloidics_mtbe7012.docx)

[Food Hygiene MTBE7030A](file:///%5C%5Cdunkelzahn.agr.unideb.hu%5Csites%5Cdefault%5Cfiles%5Cupload_documents%5Cfood_hygienie_mtbe7030a.docx)

[Food Industry Economics MTBE7025A](file:///%5C%5Cdunkelzahn.agr.unideb.hu%5Csites%5Cdefault%5Cfiles%5Cupload_documents%5Cfood_industry_economics_mtbe7025a.docx)

[Food industry Technologies and Quality Assurance MTBE7031A](file:///%5C%5Cdunkelzahn.agr.unideb.hu%5Csites%5Cdefault%5Cfiles%5Cupload_documents%5Cfood_industry_technologies_and_quality_assurance_mtbe7031a.docx)

[Food Microbiology MTBE7024A](file:///%5C%5Cdunkelzahn.agr.unideb.hu%5Csites%5Cdefault%5Cfiles%5Cupload_documents%5Cfood_microbiology_mtbe7024a.docx)

[Food Physics MTBE7003A](file:///%5C%5Cdunkelzahn.agr.unideb.hu%5Csites%5Cdefault%5Cfiles%5Cupload_documents%5Cfood_physics_mtbe7003a.docx)

Food Process Control Systems, MTBE7042A

[Functional Foods MTBE7040A](file:///%5C%5Cdunkelzahn.agr.unideb.hu%5Csites%5Cdefault%5Cfiles%5Cupload_documents%5Cfunctional_foods_mtbe7040a.docx)

[General and Inorganic Chemistry MTB7006A](file:///%5C%5Cdunkelzahn.agr.unideb.hu%5Csites%5Cdefault%5Cfiles%5Cupload_documents%5Cgeneral_and_inorganic_chemistry_mtb7006a.docx)

[Industrial Microbiology, MTBE7019A](file:///%5C%5Cdunkelzahn.agr.unideb.hu%5Csites%5Cdefault%5Cfiles%5Cupload_documents%5Cindustrial_microbiology_mtbe7019a.docx)

[Informatics, MTB7008A](file:///%5C%5Cdunkelzahn.agr.unideb.hu%5Csites%5Cdefault%5Cfiles%5Cupload_documents%5Cinformatics_mtb7008a.docx)

[Instrumental Analytics MTBE7020A](file:///%5C%5Cdunkelzahn.agr.unideb.hu%5Csites%5Cdefault%5Cfiles%5Cupload_documents%5Cinstrumental_analytics_mtbe7020a.docx)

[Introduction to Food Safety MTBE7004A](file:///%5C%5Cdunkelzahn.agr.unideb.hu%5Csites%5Cdefault%5Cfiles%5Cupload_documents%5Cintroduction_to_food_safety_mtbe7004a.docx)

Introduction to Microbiology MTBE7018A

[Mathematics, MTB7005A](file:///%5C%5Cdunkelzahn.agr.unideb.hu%5Csites%5Cdefault%5Cfiles%5Cupload_documents%5Cmathematics_mtb7005a.docx)

[Measurement Technics and Administration, MTBE7022BA](file:///%5C%5Cdunkelzahn.agr.unideb.hu%5Csites%5Cdefault%5Cfiles%5Cupload_documents%5Cmeasurement_technics_and_administration_mtbe7022a.docx)

Modern Bioanalytical Methods, MTBE7018A

[Molecular and Cell Biology , MTBE7001A](file:///%5C%5Cdunkelzahn.agr.unideb.hu%5Csites%5Cdefault%5Cfiles%5Cupload_documents%5Cmolecular_and_cell_biology_mtbe7001a.docx)

[Nutrition Knowledge, MTBE7038A](file:///%5C%5Cdunkelzahn.agr.unideb.hu%5Csites%5Cdefault%5Cfiles%5Cupload_documents%5Cnutrition_knowledge_mtbe7038a.docx)

[Oil and Fat Technology (MTBE7033A)](file:///%5C%5Cdunkelzahn.agr.unideb.hu%5Csites%5Cdefault%5Cfiles%5Cupload_documents%5Coil_and_fat_technology_mtbe7033a.docx)

[Organic Chemistry, MTBE7002A](file:///%5C%5Cdunkelzahn.agr.unideb.hu%5Csites%5Cdefault%5Cfiles%5Cupload_documents%5Corganic_chemistry_mtbe7002a.docx)

[Packaging Technology MTBE7039](file:///%5C%5Cdunkelzahn.agr.unideb.hu%5Csites%5Cdefault%5Cfiles%5Cupload_documents%5Cpackaging_technology_mtbe7039.docx)

[Physical Chemistry MTBE7008A.](file:///%5C%5Cdunkelzahn.agr.unideb.hu%5Csites%5Cdefault%5Cfiles%5Cupload_documents%5Cphysical_chemistry_mtbe7008a.docx)

[Plant Physiology MTB7014A](file:///%5C%5Cdunkelzahn.agr.unideb.hu%5Csites%5Cdefault%5Cfiles%5Cupload_documents%5Cplant_physiology_mtb7014a.docx)

[Processing and Preservation of Horticultural Products, MTBE7028A](file:///%5C%5Cdunkelzahn.agr.unideb.hu%5Csites%5Cdefault%5Cfiles%5Cupload_documents%5Cprocessing_and_preservation_of_horticultural_products_mtbe7028a.docx)

[Processing Technologies of Agricultural Crops (MTBE7021A)](file:///%5C%5Cdunkelzahn.agr.unideb.hu%5Csites%5Cdefault%5Cfiles%5Cupload_documents%5Cprocessing_technologies_of_agricultural_crops_mtbe7021a.docx)

[Professional Language Skills I. (English) MTB7NY1A](file:///%5C%5Cdunkelzahn.agr.unideb.hu%5Csites%5Cdefault%5Cfiles%5Cupload_documents%5Cprofessional_language_skills_i._english_mtb7ny1a.docx)

[Professional Language Skills II. (English) MTB7NY2A](file:///%5C%5Cdunkelzahn.agr.unideb.hu%5Csites%5Cdefault%5Cfiles%5Cupload_documents%5Cprofessional_language_skills_ii._english_mtb7ny2a.docx)

[Quality Control of Animal Origin Food Products MTBE7037A](file:///%5C%5Cdunkelzahn.agr.unideb.hu%5Csites%5Cdefault%5Cfiles%5Cupload_documents%5Cquality_control_of_animal_origin_food_products_mtbe7037a.docx)

[Quality Control of Plant Origin Food Products, MTBE7036A](file:///%5C%5Cdunkelzahn.agr.unideb.hu%5Csites%5Cdefault%5Cfiles%5Cupload_documents%5Cquality_control_of_plant_origin_food_products_mtbe7036a.docx)

[Raw Materials of Food Processing, MTBE7015A](file:///%5C%5Cdunkelzahn.agr.unideb.hu%5Csites%5Cdefault%5Cfiles%5Cupload_documents%5Craw_materials_of_food_processing_mtbe7015a.docx)

[Regulation and Administration of Agriculture MTB7029A](file:///%5C%5Cdunkelzahn.agr.unideb.hu%5Csites%5Cdefault%5Cfiles%5Cupload_documents%5Cregulation_and_administration_of_agriculture_mtb7029a.docx)

[Statistics, MTB7028A](file:///%5C%5Cdunkelzahn.agr.unideb.hu%5Csites%5Cdefault%5Cfiles%5Cupload_documents%5Cstatistics_mtb7028a.docx)

[Technologies of Animal Origin Foods, MTBE7026A](file:///%5C%5Cdunkelzahn.agr.unideb.hu%5Csites%5Cdefault%5Cfiles%5Cupload_documents%5Ctechnologies_of_animal_origin_foods_mtbe7026a.docx)

Technology of Baking and Pasta Industry MTBE7035A

[Technologies of Brewing and Distilling Industries MTBE7032A](file:///%5C%5Cdunkelzahn.agr.unideb.hu%5Csites%5Cdefault%5Cfiles%5Cupload_documents%5Ctechnologies_of_brewing_and_distilling_industries_mtbe7032a.docx)

[Technology of Customer Goods and Confectionery Industry, MTBE 7034A](file:///%5C%5Cdunkelzahn.agr.unideb.hu%5Csites%5Cdefault%5Cfiles%5Cupload_documents%5Ctechnology_of_customer_goods_and_confectionery_industry_mtbe_7034a.docx)

[Technology of Vegetable Oil and Animal Fat Industry, MTBE7033](file:///%5C%5Cdunkelzahn.agr.unideb.hu%5Csites%5Cdefault%5Cfiles%5Cupload_documents%5Ctechnology_of_vegetable_oil_and_animal_fat_industry_mtbe7033.docx)

Technology of Wine and Fruit Juice Making MTBE7029A

[Theory of Measurement and Experimental Design MTBE7041A](file:///%5C%5Cdunkelzahn.agr.unideb.hu%5Csites%5Cdefault%5Cfiles%5Cupload_documents%5Ctheory_of_measurement_and_experimental_design_mtbe7041a.docx)

[Unit Operations in Food Processing I. MTBE7013BA](file:///%5C%5Cdunkelzahn.agr.unideb.hu%5Csites%5Cdefault%5Cfiles%5Cupload_documents%5Cunit_operations_in_food_processing_i._mtbe7013a.docx)

[Unit Operations in Food Processing II. MTBE7045A](file:///%5C%5Cdunkelzahn.agr.unideb.hu%5Csites%5Cdefault%5Cfiles%5Cupload_documents%5Cunit_operations_in_food_processing_ii._mtbe7017a.docx)

[Weekly Practical Assignment 1, MTBE7H1A](file:///%5C%5Cdunkelzahn.agr.unideb.hu%5Csites%5Cdefault%5Cfiles%5Cupload_documents%5Cweekly_practical_assignment_1_mtbe7h1a.docx)

[Weekly Practical Assignment 2, MTBE7H2A](file:///%5C%5Cdunkelzahn.agr.unideb.hu%5Csites%5Cdefault%5Cfiles%5Cupload_documents%5Cweekly_practical_assignment_2_mtbe7h2a.docx)

[Weekly Practical Assignment 3, MTBE7H3A](file:///%5C%5Cdunkelzahn.agr.unideb.hu%5Csites%5Cdefault%5Cfiles%5Cupload_documents%5Cweekly_practical_assignment_3_mtbe7h3a.docx)

[Weekly Practical Assignment 4, MTBE7H4A](file:///%5C%5Cdunkelzahn.agr.unideb.hu%5Csites%5Cdefault%5Cfiles%5Cupload_documents%5Cweekly_practical_assignment_4_mtbe7h4a.docx)

**Agricultural chemistry (MTB7022A)**

**Name and title of the person responsible for the subject:** Balláné Dr. Kovács Andrea, associate professor

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

**Name and level of the program:** Agricultural Engineering BSc

**Subject type:** obligatory

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

**Credit value of the subject: 4**

**Purpose of teaching the subject:**

The general objective of the subject is to train students who are familiar with the chemical and agrochemical basics, the main theoretical and practical features of plant nutrition and nutrient management, which are essential in crop production within the sectors of agricultural production. They have a good understanding of the role and potential of nutrient supply methods.They are familiar with the role of macro- and micro-nutrients in plants, the composition of macro- and micro-nutrient fertilisers, their physical and chemical properties and their effects on the environment. They acquire a general knowledge of the types of organic fertilisers and their environmental effects. Theoretical principles of fertiliser recommendation.

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

1/ Chemical composition of plants (water, ash, organic matter content).

2/ Plant nutrients and their classification.

3/ Nutrient uptake by plant roots and leaves and influencing factors of nutrient uptake.

4/ Water balance of the plant and influencing factors. Effects of nutrient supply on the crop yield.

5/ Effects of nutrient supply on the quality of cereals, tuber crops, oilseeds, vegetables and fruits.

6/ Cation adsorption, anion adsorption in soil

7/ Nitrogen, phosphorus in soil, their uptake, their role in plants

8/ Potassium, calcium, magnesium, sulphur in soil, their uptake, their role in plants

9/ Nitrogen fertilizers and their application

10/ Phosphate fertilizers and their uses, Potassium fertilizers and their uses, Magnesium fertilizers and their uses

11/ Micronutrient fertilizers and their uses, Compound and mixed fertilizers. The potential environmental impact of fertilisers

12/ Chemical soil improvement, lime fertilisation.

13/ Formation, properties and uses of organic fertilizers.

14/ Assessment of soil nutrient status, bases of fertilizer recommendation

**practices:**

1. Laboratory safety, basic laboratory tools, basics of mass and volume measurements
2. Determination of water content, ash and organic matter content of plant
3. Determination of plant available phosphorus of soil
4. Determination of plant available potassium of soil
5. Calibration process of analytical instrument, counting the amount of AL-P2O5 and AL-K2O, determination of N, P, K supply of soil
6. Plant tissue analysis
7. Analysis of chemical parameters of fertilizers

**Type of mid-term examination:**

The successful completion of two written reports from the practicals is compulsory during the semester. Unsuccessful reports may be corrected twice. Participation in the practicals and 60% of the written reports are required for the semester to be recognised. Failure to meet the practical requirements will result in the semester not being recognised.

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

The semester is concluded with a colloquium.To apply for the colloquium, you must meet the practical requirements.

**Teaching aids:**

1. J. L. Havlin; S.L. Tisdale; W. L. Nelson; J. D. Beaton: Soil Fertility and Fertilizers an introduction to nutrient management ISBN-13: 978-0-13-503373-9.

2. K. Mengel and E. A. Kirkby (1987). Principles of plant nutrition, Lang Druck AG, Liebefeld/Bern, 685p. ISBN:3-906-535037

3. Benton jones, Jr. (2012). Plant nutrition and soil fertility manual, CRC press, Taylor and Francis Group, 282p. ISBN: 978-1-4398-1609-7

**Agricultural history, MTB7004A**

**A tantárgyfelelős neve, beosztása: Fekete István – egyetemi tanársegéd**

**Szak neve: Mezőgazdasági mérnök BSc**

**Tantárgy típusa: kötelező**

**A tantárgy oktatási időterve, vizsga típusa: 1. félév (2+0), kollokvium**

**A tantárgy kredit értéke: 3**

**A tárgy oktatásának a célja:**

The aim of the course is to introduce the history of the development of agriculture and agricultural economy in Hungary and in the world from the beginnings to the present. It also aims to deepen the specific and general knowledge of the profession, with particular emphasis on the history of the development of European and Hungarian agriculture. The curriculum will include a general description of the historical past, the present and the near future, and their development.

**A tantárgy tartalma** (14 hét bontásban):

Lecture 1: Subject requirements, topics. Basic concepts.

Lecture 2: The development of agriculture, its ancient forms in the world and in early Hungarian society, Greek and Roman slave agriculture

Lecture 3: Feudal socio-economic conditions and the development of agriculture in Europe in the Middle Ages and the late Middle Ages (6th - 15th centuries).

Lecture 4: Feudal socio-economic conditions and the development of agriculture in Hungary in the Middle and Late Middle Ages (X-XVII centuries)

Lecture 5: The history of the development of capitalist economy and agriculture in the 15th and 19th centuries

Lecture 6: The economy and agricultural economy of Hungary in the transition from classical feudalism to capitalism (1711-1867)

Lecture 7: The emerging and the advanced capitalist economy and agriculture in dualist Hungary (1849-1914)

Lecture 8: Main features and development of the world economy between the two world wars (1920-1945)

Lecture 9: History of the development of Hungarian agriculture between the two world wars (1918-1939)

Lecture 10: Main trends in the economy and agricultural development of developed countries after the Second World War

Lecture 11: The development of Hungarian agriculture after 1945

Lecture 12: General characteristics and trends in the transformation of Hungarian agriculture after the 1989/90 regime change

Lecture 13: Short history of the development of the European Union

Lecture 14: Regions and regionalism in the European Union

**Évközi ellenőrzés módja** (*a foglalkozásokon való részvétel előírásai és félévközi ellenőrzésének módja, a vizsgára bocsátás és aláírás feltételei*):

During the exam period, a one-hour written exam in which students answer five to six comprehensive questions.

**Számonkérés módja** (*félévi vizsgajegy kialakításának módja – beszámoló, gyakorlati jegy, kollokvium, szigorlat*): **kollokvium**

**Oktatási segédanyagok:**

előadásanyagok (ppt prezentáció), tankönyvek

**Ajánlott szakirodalom:**

1. Peter Gunst: Agrarian development and social change in Eastern Europe, 14th-19th centuries, ISBN 9780860785989, Published August 22, 1996 by Routledge, 336 Pages

2. János Banaji: Agrarian change in late antiquity : gold, labour, and aristocratic dominance, Oxford, [U.K.] ; New York : Oxford University Press, 2002, ISBN 0199244405

3. Gábor Demeter: Agrarian transformations in Southeastern Europe : from the late 18th century to World War II, Institute of History, Bulgarian Academy of Sciences, Szófia. ISBN 978-954-2903-31-4

4. László Makkai: Agrarian landscapes of historical Hungary in feudal times, Studia historica Academiae Scientiarum Hungaricae, Akadémiai Kiadó, Budapest 1980, ISBN 963 05 2553 4

5. Political economy of agrarian reform in Central and Eastern Europe / ed. by Johan F. M. Swinnen, Aldershot ; Brookfield etc. : Ashgate, [1997], ISBN 1859725600

6. Agriculture in Economic Development. Edited by Carl Eicher and Lawrence Witt, New York : McGraw-Hill, cop. 1964

7. Vera Zimányi: Economy and society in sixteenth and seventeenth century Hungary : 1526-1650, Studia historica / Academiae Scientiarum Hungaricae, Akadémiai Kiadó, Budapest, 1987, ISBN 963 05 4404 0

8. Economic integration and interdependence in Central and Eastern Europe / edited by Zoltán Felméry, Dialóg Campus, Budapest 2020, ISBN 978-963-531-210-8

**Analytical chemistry, MTBE7009**

ECTS Credit Points: 4

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

Type of exam: practical course mark

**Requirements:**

- for signature: Participate in the practices and successful practice tests.

- for a grade: Written exam (minimum marks when percentage is 60%).

**Summary of content - theory**:

The basic objective of the course is to acquaint students with the most important general analytical knowledge required to determine the quality and composition of the food and food ingredients.

 **lectures:**

1. Introduction to analytical chemistry. History of analytics.
2. Basic concepts. Prefixes. Units and standards. Units of measurement. Metric system.
3. SI units, SI supplementary units and SI derived units.
4. Length, weight, time, electric current, thermodynamic temperature, amount of the substance and luminous intensity.
5. Metrology.
6. The errors of an analysis results.
7. The main steps of a multielemental analysis.
8. Calibration method. Standard addition method. Internal standard method. Spiking method.
9. The Fresenius's classification criteria of cations. The Fresenius's classification criteria of anions.
10. The general methods of quantification.
11. The fundamentals of quality assurance of analyses.
12. Classical analysis, titrimetric. Acid-base titrations. Complexometry.
13. Celatometries titration. Precipitation titration. Redox titration.
14. Classical analysis, gravimetry.

**practices:**

1. Formulas of chemical compounds
2. Balancing chemical equations
3. Balancing redox reactions using oxidation numbers
4. Introduction of laboratory equipment. Concentration calculation I.
5. Concentration calculation II.
6. Concentration calculation III.
7. Acid-base titration I.
8. Acid-base titration II.
9. Acid-base titration III.
10. Acid-base titration IV.
11. Complexometric titration I.
12. Complexometric titration II.
13. Permanganometric titration I.
14. Permanganometric titration II.

**Literature**

Giinzler, H., Williams, A.: 2001. Handbook of Analytical Techniques. WILEY-VCH, Weinheim, Germany.

Ebbing, D. D., Gammon, S. D.: 2009. General chemistry. Houghton Mifflin Company. Boston. USA.

Danzer, K.: 2007. Analytical chemistry. Theoretical and metrological fundamentals. Springer-Verlag. Berlin Germany.

Skoog, D. A., West, D. M., Holler, F. J.: 1992. Fundamentals of Analytical Chemistry. ed. Saunders College Publ. Fort Worth, Texas (USA).

**Animal physiology, MTBE7005BA**

ECTS Credit Points: 4

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

Type of exam: exam mark

**Requirements:**

- for signature: Participating in the lecture / practice.

- for a grade: Oral exam.

**Summary of content - theory**:

To provide information on the anatomy and function of the animal body especially those affecting the quality of raw materials of animal origin.

 **lectures:**

1. Current trends in meat consumption.
2. Main parts of the animal body and their function
3. Tissues of the animal body and their function and homeostasis
4. Animal digestive system and its function
5. Movement and locomotion
6. Animal endocrine system and its function
7. Animal respiratory system and its function
8. Animal circulatory system and its function
9. Animal reproduction
10. Lactation physiology
11. Physiology of egg production
12. Physiology of meat production
13. Hygiene in animal production
14. Animal welfare

**practices:**

1. Dairy technology
2. Technology issues of milk quality
3. Beef technology
4. Technology issues of beef quality
5. Sheep and goat farming
6. Technology issues of milk & meat quality
7. Poultry farming
8. Technology issues of poultry meat quality
9. Pig farming
10. Technology issues of pork quality

**Literature:**

R.D. Frandson, W.L. Wilke, A.D. Fails, Anatomy and Physiology of Farm Animals, 7th ed., Wiley-Blackwell, Iowa, 2009, ISBN9780813813943, 512 pp.

P.B.Reddy: Text Book of Animal Physiology. Ratna Prasad Multidisciplinary Research & Educational Society 2015 DOI: 10.13140/RG.2.1.4807.9441

[**Baking and Pasta Technology, MTBE7035A**](file:///%5C%5Cdunkelzahn.agr.unideb.hu%5Csites%5Cdefault%5Cfiles%5Cupload_documents%5Cbaking_and_pasta_technology_mtbe7035a.docx)

**Basic Food Engineering Skills MTBE7044A**

ECTS Credit Points: 3

0 hour(s) lecture and 54 hour(s) seminar per semester (0+4/week) (Lecture hours: 2, Practice hours: 1)

Type of exam: Written and oral exam

**Requirements:**

- for signature: 3 allowed absences per semester. Completing assignments / exercises.

- for a grade: the final grade will be divided as follows: 25% (attendance and participation) + 25% (Presentation (75% individual +25% group) + 25% (50% assignments / exercises + 50% quiz) + 25% (written and oral exam)

Summary of content - theory:

The course aims to provide students with enough skills to participate in laboratory work and food industry. Students attain knowledge of basic food engineering, the different types of materials on planet earth, and their implementation in food engineering. Also, students will be provided with enough skills to understand the system and its state. Some information about the nutrient cycle from soil to food and their analysis, also will be explained.

**practices:**

1. Review of Mathematical Principles and Applications in Food Processing
2. Dimensions, Engineering Units, System, State of A System
3. Density, Mass, Volume, Percent Composition
4. Concentration (1)
5. Concentration (2)
6. Micro And Macro Elements in Soil Plant System/ Plant, Food, And Soil Analysis (1)
7. Micro And Macro Elements in Soil Plant System/ Plant, Food, And Soil Analysis (2)
8. Midterm Exam
9. Basic Material Science for Food Engineering.
10. Operations in Food Engineering and Efficiency for Industrial Food Processing (1)
11. Operations In Food Engineering and Efficiency for Industrial Food Processing (2)
12. Revision+ Presentation+ Evaluation
13. End Term
**Literature**

Singh, R. P., & Heldman, D. R. (2001). Introduction to food engineering. Gulf Professional Publishing.

Toledo, Romeo T., Rakesh K. Singh, and Fanbin Kong. Fundamentals of food process engineering. Vol. 297. New York: Springer, 2007.

**Basic principles of food mechanics, MTBE7011A**

ECTS Credit Points: 4

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

Type of exam: written exam

**Requirements:**

- for signature: Completing assignment, giving presentation, Attending practice / factory visits.

- for a grade: 50% of course grade from assignment + presentation, and 50% of course grade from written exam.

**Summary of content – theory**

To become familiar with the most important technological operations applied in the scope of food industry, their theoretical connections and the machinery utilised in practice. The student will become up-to-date with the task, field of utilisation and conditions of the given item of machinery. Graduated experts will be able to select the most appropriate devices for each task. Also, graduated students will become capable of operating the machinery and devices. Besides, the students will be able to participate in the repairing processes in case the machinery is malfunctioning. The objective is to train experts who are responsive to the reception of knowledge required for the operation of food industry equipment, devices and in possession of such knowledge they are able to participate in the planning process of food-related raw material production, processing and management. The graduated students are able to participate in the organisation and control of the activities in the scope of the daily practice.

 **lectures:**

Week 1: Machines of transportation and conveyance I: Gravitational and mechanic conveyance

Week 2: Machines of transportation and conveyance II: conveyance in air flow

Week 3: Devices of chopping, cutting, grinding I.: Refiners, mills, grinders, vegetable slicers, shredders

Week 4: Devices of chopping, cutting, grinding II.: Meat mincer, bacon dicer, bowl cutter

Week 5: Technology of meat processing, slaughterhouse,

Week 6: Devices of classification and sorting I. Vegetable and fruit classification devices, sieve, screen

Week 7: Devices of classification and sorting II. Magnetic sorting, separator, air classifiers, hydro cyclone

Week 8: Technology of separation processes I: Settling, Filtering

Week 9: Technology of separation processes II: Centrifugation

Week 10: Mixer devices, agitators, homogenisation

Week 11: Technology of pressing, squeezing

Week 12: Refrigerators, refrigerating devices

Week 13: Evaporation devices

Week 14: Devices of washing

**practices:**

1. Extending the knowledge of the theory lessons by practical explanation, calculations and related multimedia material
2. Help students to prepare for the course assignment and the final presentation
3. Factory visits to food companies to observe the related machinery in operation
4. The last practice lesson is for the students’ presentation and the evaluation of the assignment.

**Literature:**

Smith, P. G.: Introduction to Food Process Engineering. Springer Science+Business Media. 2011. ISBN: 978 1 4419 7661 1

Serna-Saldivar, Sergio O.: Cereal Grains. Properties, Processing, and Nutritional Attributes. Taylor and Francis Group, LLC. 2010. ISBN: 978 1 4398 1560 1

Hui, Y. H. – Ghazala, Sue – Graham, Dee M. – Murrell, K. D. – Nip, Wai-Kit: Handbook of Vegetable Preservation and Processing. Taylor and Francis Group. 2003. ISBN: 9780824743017

Sinha, Nirmal K. – Sidhu, Jiwan S. - Barta, J. - Wu, James S. B. - Cano, Pilar M.: Handbook of Fruits and Fruit Processing. Wiley-Blackwell. 2012. ISBN: 978-0-8138-0894-9

**Biochemistry, MTBE7007A**

ECTS Credit Points: 3

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

Type of exam: written exam

**Requirements:**

- for signature: 80% participation in the lectures and in the practice

- for a grade: Submitting essay

 **lectures:**

1. Foundations of biochemistry. The molecular logic of life, the chemical unity of the diverse living organisms. Energy production and consumption in metabolism. Biological information transfer. The physical roots of the biochemical world. Cells. Major structural features of eucariotic cells. Evolution of multicellular organisms and cellular differentiation. Biomolecules. Chemical composition and bondings. Three dimensional structure: configuration and conformation. Chemical reactivity. Water. Weak interactions in aqueous systems. Ionization of water, weak acids, weak bases. Buffering against pH changes in biological systems.

2. Structure and catalysis. Amino acids, peptides and proteins. The three dimensional structure of proteins. Protein functions. Complementary interactions between proteins and ligands. Protein interactions modulated by chemical energy.

3. Enzymes. Enzyme kinetics as an approach to understanding mechanism. Examples of enzymatic reactions. Regulatory enzymes. Conformational changes, allosteric enzymes, Michaelis-Menten behavior, reversible covalent modification, proteolytic cleavage of enzyme precursors, multiply regulatory mechanisms.

4. Carbohydrates and glycobiology. Monosaccharide, disaccharides polysaccharides. Starch and glycogen, cellulose and chitin, bacterials cell walls, peptidoglycanes. Glycoconjugats, proteoglycans, glycoproteins, glycolipids. Nucleotids and nucleic acids. Nucleic acid structure, chemistry and other functions of nucleotids. Bases and pentoses, phosphodiester bonds, three dimensional structure, genetic information, distinctive base composition, double helix. Nucleotids and chemical energy, nucleotids are components of many enzyme cofactors, regulatory molecules.

5. Lipids. Storage lipids, fatty acids, triacyl glycerols, structural lipids in membranes, phospholipids and sphingolipids. Steroid hormons and vitamins. Biological membranes and transport. The molecular constituents of membranes. The supermolecular architecture of membranes, solute transport across membranes, active transport, passive transport, ion channels, transmembrane channels for small molecules.

6. Bioenergetics and metabolisms. Bioenergetics and thermodinamics. Phosphoryl group transfer and ATP. The free energy change for ATP hydrolysis, other phosphorilated components and thioesters, transphosphorilation, biological oxidation-reduction reactions, dehydrogenesis (NAD, NADP, FAD).

7. Glycolysis and the catabolism of hexoses. Glycolysis, preparatory and payoff phase, produces ATP and NADH, fates of pyruvate under aerobic and anaerobic conditions, feeder pathways of glycolysis, regulation of carbohydrate catabolism, the pentose phosphate pathways of glucose oxidation. The citric acid cycle. Production of acetate, reactions of the citric acid cycle, regulation of the citric acid cycle, the glyoxylate cycle.

8. Oxidation of fatty acids. β Oxidation of saturated, unsaturated and odd number fatty acids, the four steps to yield acetyl-CoA and ATP, regulation of β oxidation, ketone bodies formed in the liver, ketone bodies and diabetes and starvation. Amino acid oxidation and production of the urea. Metabolic fates of amino groups, enzymatic degradation of the proteins to amino acids, nitrogen excretion and the urea cycle, enzymatic steps of urea production, regulation of the urea cycle, connection between citric acid and urea cycle, pathways of amino acid degradation, glucose and keton body production from amino acids.

9. Oxidative phosphorilation and photophosphorilation. Electron transfer reactions in mitochondria, ATP synthesis, regulation of oxidative phosphorylation, photosynthesis, harvesting light energy, photophosphorilation, light absorption, light driven electron flow, ATP synthesis by phosphorilation.

10. Carbohydrate biosynthesis. Gluconeogenesis, conversion of pyruvate and amino acids into glucose, the expensive gluconeogenesis, gluconeogenesis in germinating seeds. Biosynthesis of glycogen, starch, sucrose and other carbohydrates. Photosynthetic carbohydrates synthesis. Regulation of carbohydrate metabolisms in plants.

11. Lipid biosynthesis. Biosynthesis of fatty acids and eicosanoids. Regulation of fatty acid biosynthesis. Synthesis of the long chain fatty acids. Biosynthesis of triacyl glycerols, membrane phospholipids, cholesterol, steroids and isoprenoids.

12. Biosynthesis of amino acids, nucleotids and related molecules. Nitrogen metabolisms, nitrogen fixation, biosynthesis of amino acids, allosteric regulation of the amino acid biosynthesis, molecules derived from amino acids, biosynthesis and degradation of nucleotides, purine and pirimidine nucleotides, uric acid production.

13. Genes and chromosomes. Size and sequence structure of DNA molecules, supercoiling, DNA replication, repair and recombination. RNA metabolisms, DNA dependent synthesis of RNA, RNA dependent synthesis of RNA and DNA.

14. Protein metabolisms. The genetic code. Protein synthesis, initiation, elongation, termination, different RNAs in protein synthesis, folding and processing of polypeptide chain, protein targeting and degradation, posttranslational modification and glycosylation.

**Summary of content - practice**:

**Tasks and solutions:**

**1. Practice**

1. Acidity of gastric HCl

2. Vitamin C: Is the synthetic vitamin as good as the natural one?

3. Separating biomolecules

4. Properties of a buffer

5. The effect of pH on solubility

6. Ionization state of amino acids

**2. Practice**

7. Separation of amino acids by ion exchange chromatography

8. The size of proteins

9. The number of tryptophan residues in bovine serum albumin

10. Isoelectric point of pepsin

11. The isoelectric point of histones

12. Solubility of polypeptides

**3. Practice**

13. Sequence determination of the brain peptide leucine enkephalin

14. Disulfide bonds determine the properties of many proteins

15. Amino acid sequence and protein structure

16. Bacteriorhodopsin in purple membrane proteins

17. Keeping the sweet taste of corn

18. Rate enhancement by urease

19. Protection of an enzyme against denaturation by heat

**4. Practice**

20. Determination of an empirical formula

21. Sugar alcohols

22. A taste of honey

23. Physical properties of cellulose and glycogen

24. Information content of oligosaccharides

25. Nucleotide structure

26. Base sequence of complementary DNA strands

**5. Practice**

27. Operational definition of lipids

28. Melting points of lipids

29. Preparation of Béarnaise sauce

30. Alkali lability of triacylglycerols

31. Storage of fat-soluble vitamins

32. Ninhydrin to detect lipids on TLC plates

**6. Practice**

33. Properties of lipids and lipid bilayers

34. Lipid melting temperatures

35. Entropy changes during egg development

36. Rates of turnover of γ and βphosphates of ATP

37. Equation for the preparatory phase of glycolysis

38. The payoff phase of glycolysis in skeletal muscle

39. Fermentation to produce soy sauce

**7. Practice**

40. Efficiency of ATP production in muscle

41. Free-energy change for triose phosphate oxidation

42. Role of the vitamin niacin

43. Muscle wasting in starvation

44. Energy cost of a cycle of glycolysis and gluconeogenesis

45. Glycogen breakdown in migrating birds

**8. Practice**

46. Balance sheet for the citric acid cycle

47. Stimulation of oxygen consumption by oxaloacetate and malate

48. Respiration studies in isolated mitochondria

49. Role of the vitamin thiamine

50. Synthesis of oxaloacetate by the citric acid cycle

51. Relationship between respiration and the citric acid cycle

**9. Practice**

52. Energy in triacylglycerols

53. Fuel reserves in adipose tissue

54. Common reaction steps in the fatty acid oxidation cycle and Citric Acid Cycle

55. Compartmentation in β-oxidation

56. Fatty acids as a source of water

57. Petroleum as a microbial food source

**10. Practice**

58. Fatty acid oxidation in uncontrolled diabetes

59. Oxidation of arachidic acid

60. Fate of labelled propionate

61. Biological importance of cobalt

62. Fat loss during hibernation

**11. Practice**

63. Products of amino acid transamination

64. Distribution of amino nitrogen

65. Ammonia intoxication resulting from an arginine-deficient diet

66. Oxidation of glutamate

67. Alanine and glutamine in the blood

**12. Practice**

68. Compartmentalization of citric acid cycle components

69. Cellular ADP concentration controls ATP formation

70. Synthesis of fatty acids from glucose

**13. Practice**

71. Regulation of cholesterol biosynthesis

72. ATP consumption by root nodules in legumes

73. Transformation of aspartate to asparagine

**14. Practice**

74. Equation for the synthesis of aspartate from glucose

75. Phenylalanine hydroxylase deficiency and diet

76. Nucleotides as poor sources of energy

77. Treatment of gout

**Literature, handbooks**

Lehninger, A. L.–Nelson, D. L.–Cox, M. M.: 2000 *Principles of biochemistry*. New York, Worth Publishers, Inc.

Michal, G.–Schomburg, D.: 2012 *Biochemocal pathways: An atlas of biochemistry and molecular biology*. New York, John Wiley & Sons.

Holme, D. J.–Peck, H.: 1998 *Analytical biochemistry*. New York, Addison Wesley Longman Limited.

Fox, M. A.–Whitesell, J. K.: 1997 *Organic chemistry*. Sudbury, Jones and Bartlett Publishers, Inc.

Ebbing, D. D.: 1996 *General chemistry*. Ed.: Mark S. Wrighton. Boston, Houghton Mifflin Co.

Chesworth, J. M.–Stuchbury, T.–Scaife, J. R.: 1998 *Agricultural biochemistry*. London, Chapman & Hall.

**Chemometry MTBE7043A**

ECTS Credit Points: 3

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

Type of exam: Practice grade

**Requirements:**

- for signature: Attendance to lectures/seminars

- for a grade: practice grade, essays

**Summary of content - theory**:

The development and application of sensitive and selective analytical methods is required for the effective development and quality control in the food industry. One can recently witness a silent revolution either in the process automation and or in analytical technology. The food industry is a part of this evolution. Various companies offer PAT (process analytical technology) systems based on image and spectroscopic sensory (NIR, RAMAN) analysis. These technical solutions are

presented by dozens of spectacular booklets and more or less well trained service engineers. Less information is provided about how the actual qualitative and quantitative results are computed from the sensor signals. Although for a company it is crucial for the in-house development and maintenance of a PAT system customized for a product or production step using the existing expert team. This course offers a basic insight into the most widely used multivariate classification and calibration techniques with easily understandable practical examples.

**lectures:**

1-2. Introduction to the spectroscopic methods, interaction of the material and the electromagnetic radiation, methods and sensors in the daily routine

3-4. Evolution and properties of spectra. Construction of data matrices, visual observation, basic descriptive statistical tools.

5-6. Classification methods (I): factor analysis, PCA (principal component analysis), LDA (linear

discriminant analysis)

7-8. Classification methods (II):), ANN (artificial neural networks), SIMCA (self-independent modelling of class analogies) , SVM (support vector machines), cluster analysis

9-10. Regression methods (I): linear and multilinear regression, PCR (principal component regression)

11-12. Regression methods (II): PLS, PLS-DA (partial least squares regression and discriminant analysis)

13-14. Internal and external validation

**practices:**

1-4. Non-destructive determination of elemental composition of alloys and its use in classification models

5-8. RAMAN spectrum recording and classification of various cheese samples (PCA, LDA)

9-12. Determination of food dye concentration by image analysis and multivariate regression (PLS, PCR)

13-14. Application of NIR spectroscopy in the analysis of different skin types (LDA, SIMCA)

**Literature, handbooks in English**

Füstös László: A sokváltozós adatelemzés módszerei, Módszertani Füzetek, 2009/1.

S.N. Deming, Y. Michotte, D.L. Massart, L. Kaufman, B.G.M. Vandeginste: Chemometrics:

A Textbook, Elsevier, 1988

**Dairy industry technology MTBE7027A**

**A tantárgyfelelős neve, beosztása: Fekete István – egyetemi tanársegéd**

**Szak neve: Élelmiszermérnök BSc**

**Tantárgy típusa: kötelező**

**A tantárgy oktatási időterve, vizsga típusa: 5. félév (1+0), kollokvium**

**A tantárgy kredit értéke: 3**

**A tárgy oktatásának a célja:**

Aim of education of course to provide the necessary theoretic information on the dairy industry, production and preservation of dairy products including technology issues.

**A tantárgy tartalma** (14 hét bontásban):

1. Primary production of milk, milking technology on the farm, chilling milk on the farm
2. The composition of milk, health Benefits of Dairy products
3. Collection and reception of milk, testing milk for quality
4. Raw-milk storage, General milk treatment (pasteurization)
5. General milk treatment (clarification and cream separation, homogenization)
6. Processing of pasteurised market milk
7. Processing of cultured-milk products
8. Buttermaking
9. Cheese production (Regulations of producting cheese, definitions, physical-, chemical- and sensory properties of the cheese, nutritional role of cheese, materials of production
10. Cheese production (Making of 'Trappista', a special semi-hard cheese, and making of Camembert cheese)
11. Production of fresh cheese (cottage cheese, quark), Production of processed cheese
12. Usage of the dairy industry by-products
13. Production milk powder, and condensed milk
14. Production of ice-cream

**Évközi ellenőrzés módja** (*a foglalkozásokon való részvétel előírásai és félévközi ellenőrzésének módja, a vizsgára bocsátás és aláírás feltételei*):

During the exam period, a one-hour written exam in which students answer five to six comprehensive questions.

**Számonkérés módja** (*félévi vizsgajegy kialakításának módja – beszámoló, gyakorlati jegy, kollokvium, szigorlat*): **kollokvium**

**Oktatási segédanyagok:**

előadásanyagok (ppt prezentáció), tankönyvek

**Ajánlott szakirodalom:**

Chandan, R.C., Kilara, A., Shah, N.P. (2018): Dairy Processing and Quality Assurance. 2008 & 2016 by John Wiley & Sons Ltd. p.663

Teknotext AB (1995). Dairy processing handbook. Tetra Pak Processing Systems AB. S-221 86 Lund, Sweden. p.442

Datta, N., Tomasula, P.M. (2015): Emerging Dairy Processing Technologies: Opportunities for the Dairy Industry 2015 by John Wiley & Sons, Ltd. p.362

**Economic sciences I., MTB7020\_AA and MTB7020\_BA**

Name and title of the person responsible for the subject: Andrea Bauerné Gáthy, PhD

Additional instructors involved in teaching the subject:

Name and level of the program: Food Engineering BSc, II. (élelmiszermérnök BSc (angol nyelven) )

Subject type: Compulsory

Teaching timetable of the subject, type of examination: Colloquium

Credit value of the subject: 2

Purpose of teaching the subject: The first half of the semester focuses on the principles of the economic way of thinking and the basic concepts of microeconomics, whereas the second part is concerned with the most important macro- and microeconomic variables and their measurement. After an overview of the subject, method, and principles of economic thinking, the course considers the model of demand and supply and its applications. Of the many macroeconomic variables, the course concentrates on GDP and price indices. Besides, stylized facts of economic growth, the labour market, money, and finance are also discussed.

Content of the subject (14 weeks):

1. Basic concepts and fundamental questions of economics

2. Ten principles of economics and the economic way of thinking I. (Understanding the basic concepts of rational decisions)

3. Ten principles of economics and the economic way of thinking II. (Understanding the market as a process of cooperation and the metaphor of the invisible hand)

4. Production possibilities frontier (Graphical representation of opportunity cost)

5. How markets work: demand and supply I. (Understanding the concept of demand and supply and their determinants)

6. How markets work: demand and supply II. (The meaning of the equilibrium (market-clearing) price, and comparative statics)

7. Measuring a nation’s income (Understanding the notions of nominal and real GDP)

8. Measuring the cost of living (The meaning of the price level and inflation, GDP deflator and the consumer price index)

9. Exercises on measurement (Exercises in calculating GDP and inflation)

10. Savings and investment, and the role of the financial system (The market for loanable funds, and the determination of the real interest rate)

11. Money and inflation I. (Definition of money, understanding the significance of using money in trade)

12. Money and inflation II. (The role of the banking system in money creation)

13. Unemployment (The fundamentals of the labour market)

14. Summary (Systematic review of the topics discussed)

Type of mid-term examination: -

Method of assessment (semester examination mark - report, practical grade, colloquium, examination): Colloquium. Students’ performance will be evaluated based on a written exam in the exam period.

Teaching aids: Lecture slides and compulsory readings

Recommended literature:

Compulsory readings:

Mankiw, Gregory: Principles of Economics. Fifth Edition. South-Western, Mason, USA, 2009. ISBN-13: 978-0-324-58998-6

Recommended readings:

Heyne, Paul – Boettke, Peter – Prychitko, David: The Economic Way of Thinking. Twelfth Edition. Pearson Education International, New Jersey, 2010. ISBN-10: 0132991292

Alchian, Armen, A.; Allen William R.: Universal Economics. Edited by Jerry L. Jordan Published by Liberty Fund, 2018 https://oll.libertyfund.org/title/universal-economics

**Economic Sciences II. MTB7024\_AA and MTB7024\_BA**

ECTS Credit Points: 4

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

Type of exam: written exam

**Requirements:**

- for signature: The students shall write a test in the last week of the semester. The pre-requisitive of the signature of the course is that the score of this test will reach, or exceed 60% of the maximum score. Another pre-requisitive of the signature is the submission of an essay and the oral presentation of the individually written essay of a given field of agricultural enterprise, with the pre-given content till the deadline (the end of the 8th week of the semester). The head of the course is going to refuse to sign the course if each of the three above-mentioned requirements are unsuccessful (e.g. in case of absence from the oral presentation, or failure to meet the deadline)..

- for a grade: : Written exam..

**Summary of content – theory**

To become familiar with the basic knowledge of Farm Business Management.

**lectures:**

1. RESOURCES IN AGRICULTURE AND ITS’ SPECIALITY
2. CALCULATION OF THE AGRICULTURAL PRODUCTION
3. COSTS OF PRODUCTION AND COST-CONCEPTS FOR AGRICULTURE
4. EFFICIENCY AND IT’S MEASUREMENT IN AGRICULTURE
5. DECISION-MAKING AND RISK MANAGEMENT IN AGRICULTURAL PRODUCTION
6. ECONOMIC PRINCIPLES: CHOOSING PRODUCTION LEVELS
7. ECONOMIC PRINCIPLES: CHOOSING INPUT AND OUTPUT COMBINATIONS
8. ENTERPRISE BUDGETING AND PLANNING OF CASH FLOW
9. INVESTMENT ANALYSIS
10. FARM BUSINESS ORGANIZATIONS
11. COMPLEX PLANNING OF AGRICULTURAL PRODUCTION
12. FARM BUSINESS AND ENTERPRISE ANALYSIS
13. ECONOMICS OF PLANT PRODUCTION
14. ECONOMICS OF ANIMAL PRODUCTION

**practices:**

1. Time Value of Money, Role of time value in finance
2. Future Value versus Present Value
3. Future value calculation for single amounts
4. Present value calculation for single amounts
5. Present value of Annuity
6. Futures value of Annuity
7. Perpetuities
8. Value maximalisation of Investments
9. Weighted Average Cost Of Capital
10. Value maximalisation of Shares
11. Value maximalisation of Bonds
12. Introduction to financial analysis,
13. Analyis with ratios and indicators
14. Property analysis, Financial analysis

**Literature, handbooks**

Ronald D. Kay William M. Edwards Patricia A. Duffy: Farm Management. McGraw-Hill , 2006.

John Soloman-Elisabeth Jones: Essential Economics for Business, Pearson, Pearson, 4th Edition, 2014

John Soloman-Kevin Hinde-Dean Garratt: Economics for Business 6th edition, 2013.

F.R. David: Strategic Management, Cases and Concepts, McGraw Hill, 2012.

Berk, Jonathan: Fundamentals of Corporate Finance. Global Edition. 2014.

**Economic sciences III. MTB7026\_AA and MTB7026\_BA**

ECTS Credit Points: 3

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

Type of exam: written exam

**Requirements:**

- for signature: Passing a problem solving test.

- for a grade: Colloquium

**Summary of content – theory**

Economic knowledge is an integral part of our everyday lives. The course, based on theoretical background, presents the practice of logistic, professional consultancy and marketing. Students will know the most important planning tools and gain insight in their application, as well.

**lectures:**

1. Logistic: Introduction. The structure of value creating processes. Production processes. Service processes. The role of the operations manager. The evolution of operations management. Supply chain management. Globalization. Productivity and competitiveness.
2. Quality and quality management. The TQM and quality management systems. Quality tools. The focus of quality management: the customer. Quality improvement. Lean six sigma. ISO 9000.
3. Product design. The product design process, idea generation, feasibility study, form design, functional design, reliability, maintainability, usability, and production design. Design for environment, and design for robustness.
4. Service design. The service economy. The service design process. Tools for service design. Waiting line analysis for service improvement. Operating characteristics of the queueing system, traditional cost relationships in waiting line analysis. Psychology of waiting, queuing models.
5. Process design and technology. Outsourcing, process selection wit break even analysis. Process analysis, using process flowcharts, process development. Technology decisions: financial justification and technology primer.
6. Marketing: Orientation, course overview, Introduction Defining Marketing and the Marketing Process Company and Marketing Strategy, Understanding the Marketplace and Consumer Value, Managing Marketing Information to Gain Customer Insights
7. Consumer Markets and Buyer Behaviour, Business Markets and Business Buyer Behaviour, Designing a Customer Value-Driven Strategy and Mix, Segmentation, targeting, positioning, Products, Services, and Brands: Building Customer Value, New-Product Development and Product Life-Cycle Strategies, Pricing: Understanding and Capturing Customer Value, Pricing Strategies: Additional Considerations,
8. Marketing Channels: Delivering Customer Value, Marketing communication: Delivering Customer Value,
9. Professional consultancy: Orientation, course overview Basement of Consulting
10. Basement of Agricultural Consulting
11. Support system of Decision Making
12. Process of Agricultural Consulting
13. Operation of Agricultural Consulting Organization and Systems

**Literature, handbooks**

Russell, R. S. - Taylor, B. W. : Operations Management, 8th Edition, Wiley & Suns, INC., ISBN10 1118808908 ISBN13 9781118808900, 2014

ppt materials of the lectures

**Electrotechnics MTBE7006BA**

ECTS Credit Points: 4

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

Type of exam: practical course mark

**Requirements:**

- for signature: Attendance at lectures is recommended, but not compulsory. Participation at practice classes is compulsory. A student must attend the practice classes and may not miss more than three times during the semester. In case a student does so, the subject will not be signed and the student must repeat the course. A student can’t make up a practice class with another group. Attendance at practice classes will be recorded by the practice leader. Being late is equivalent with an absence. Missed practice classes must be made up for at a later date, being discussed with the tutor. Active participation is evaluated by the teacher in every class. If student’s behaviour or conduct doesn’t meet the requirements of active participation, the teacher may evaluate his/her participation as absence because of the lack of active participation in class. During the semester there is one test. Students have to sit for this test. Preparing measurement reports until deadline.

- for a grade: test

**Summary of content – theory**

The goal of the subject is to make the student understand the basic contexts of the food marketing especially the segmentation, the targeting and positioning. The subject emphasizes the role of the marketing mix in the food markets therefore we study the product, the price, the place and promotion tools in detail. The community marketing tools and strategies are also part of the subject

**lectures:**

1. Electrostatics, DC networks: basic electrical concepts of electric charge, electric current (amperage), electric field, electric field work, electric voltage (potential), electric circuit
2. Power source (ideal real), Power Source (ideal for real), Consumer, Ohm's Law, Resistance - design, characteristic data, division, marking according to IEC standard.
3. Passive resistance of bipolar networks, Star-delta, delta-star conversion, Electrical work, electric power, efficiency
4. Network analysis: Kirchhoff’s laws, Voltage divider, potentiometer, extending measuring range of a Volt meter current divider, extending measuring range of an Amp meter, Wheatstone bridge
5. Network analysis: Nodal analysis, Mesh analysis, superposition theory
6. Network analysis: Northon and Thevenin theory
7. 1.Test
8. AC circuit, complex number, AC circuit mean value (RMS).
9. Behaviour of a resistance in AC circuit, inductance behaviour in AC circuit, capacitance behaviour in AC circuit.
10. AC circuit network analysis, AC Kirchhoff’s laws
11. Performance of AC circuits, power factor correction, Three-phase systems
12. Transient signals in the AC circuits
13. Advanced alternating current circuits: RL, RC, RLC circuits, parallel RL, RC, RLC circuits.
14. Test

**practices:**

1. General description, laboratory regulations, Safety regulations and safety instruction
2. introduction to measurements and instrumentation (measuring error, power supply, digital multimeter, signal generator)
3. 1st measurement: measuring the characteristics of DC voltage (U, I, RB, P) using Ohm's Law. Report writing.
4. 2nd measurement: measuring the values of DC circuit. Using Kirchhoff’s laws. Report writing.
5. 3rd measurement: measuring the values of DC circuit. Using voltage and current divider. Report writing.
6. 4th measurement: Perform a complex DC measurement and calculation task. Report writing.
7. Repeat practice and consultation.
8. 5th measurement introduction to AC measurements and instrumentation (AC type digital multimeter, signal generator, oscilloscope, LRC meter). Report writing.
9. 6th measurement: Alternating current,voltage characteristics measurement (Ueff, Ieff, f, P, waveform) using Ohm’s law. Report writing.
10. 7th measurement: alternating current analysis of capacitive and inductive elements. Analysis of serial and parallel RLC circuits. Report writing.
11. 8th measurement: alternating current analysis of wien-bridge. Report writing.
12. 9th measurement: Measuring of serial RLC circuit. Report writing.
13. 10th measurement: Measuring of parallel RLC circuit. Report writing.
14. Repeat practice and consultation.

**Literature, handbooks**

Electronic Circuits: Handbook for Design and Application, U. Tietze, Ch. Schenk, 2nd edition, 2008, ISBN-10: 3540004297

**Environmental management MTB7015A**

ECTS Credit Points: 3

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

Type of exam: written exam

**Requirements:**

- for signature: Attendance at lectures is recommended, but not compulsory. A report, including the overall assessment of soil/water/air /waste problems in the country the student lives in. Active participation is evaluated by the teacher. If a student’s behaviour or conduct doesn’t meet the requirements of active participation, the teacher may evaluate his/her participation as an absence because of the lack of active participation in class.

- for a grade: Written exam

**Summary of content – theory**

**lectures:**

1. Definition of environment, environmental protection, environmental management, environmental pollution. Classification of environmental elements. Characteristics and major types of systems. The concept of model and modelling, the characteristics of the model. Principles of environmental protection.
2. Concept and classification of natural resources. Biogeochemical cycles (Carbon-, Nitrogen-, Oxygen- cycle).
3. The impact of societies on the environment (agricultural societies, urbanization, technological advances, their negative environmental effects).
4. International environmental protection is organized. Overview of major environmental conferences. Concept of sustainable development.
5. Global problems (war and peace, overpopulation, food crisis, material and energy crisis, environmental crisis).
6. Global environmental problems in details
7. Pollution of the environment, classification of pollutants, types and causes of pollution
8. Soil protection. The concept of soil, its functions. The concept of soil degradation, its causes, factors preventing soil fertility. Sources of soil contamination. Heavy metal and oil pollution of soils. Remediation technologies, phytoremediation. Self-cleaning of soils.
9. The concept, structure and composition of the atmosphere. Thinning of the ozone layer, greenhouse effect, odorous substances in the atmosphere, air pollution caused by landfills. Atmospheric aerosols. Smog grouping, characteristics. Self-cleaning of the air. x
10. Basics of water protection, Classic water rating, Collection and treatment of communal wastewater, placement of by-product
11. The effects of agricultural production. Erosion, deflation, salinization, acidification. Effects of crop production and animal husbandry on soil, water and air
12. Definition of waste, waste management and classification of waste
13. The causes of radioactive contamination. Effects of radioactive contamination on humans, flora and fauna

Characteristics and propagation of noise and sound. Noise protection laws, load limits. Noise measurement. Effects of noise on humans. Methods of noise reduction.

**Literature, handbooks**

J. C. Lovett- D. G. Ockwell.: 2010. A Handbook of Environmental Management.

J.M. Blais, M. Rosen, J.P. Smol.: 2015. Environmental Contaminants.

A. S. Kalamdhad, J. Singh, K. Dhamodharan.: 2016. Advances in Waste Management.

V. I. Grover.: 2006. Water: Global Common and Global Problems.

**Food analytics MTBE7023A**

ECTS Credit Points: 4

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

Type of exam: practical course mark

**Requirements:**

- for signature: Successful test (60%) and participation in practices

 - for a grade: Test and practical course mark

**Summary of content – theory**

Course objectives: The main aim of the lectures is to know the classic analytical methodologies and their theoretical background. The students get knowledge about different methods which are suitable for the determination of physicochemical parameters of food.

**lectures:**

1. Food ingredients; Sampling and sample preparation
2. Methodology of moisture content, ash content and electrical conductivity determination
3. Methodology of lipids determination
4. Methodology of proteins determination
5. Methodology of carbohydrates determination
6. Methodology of fibre content determination
7. Methodology of vitamin determination
8. Methodology of enzyme determination
9. Methodology of antioxidant determination
10. Methodology of amino acid determination
11. Methodology of acid content and acidity determination
12. Methodology of alcoholic beverages’ nutritional parameter determination
13. Methodology of sensory analysis
14. Methodology of nutritional value calculation

**Summary of content - practice**:

The main aim of the practices is to carry out different classic analytical methods in the laboratory. At the end of this semester, students will be able to prepare samples and to determine the nutritional parameters of different food.

**practices:**

1. Safety training
2. Determination of dry matter content, ash content and electrical conductivity
3. Determination of fat content
4. Determination of nitrogen and protein content
5. Determination of total carbohydrate content
6. Determination of total dietary fibre content
7. Determination of vitamin C
8. Determination of diastase activity
9. Determination of total phenolic and flavonoid content
10. Determination of proline content
11. Determination of acid content, acidity and pH
12. Determination of physicochemical parameters of alcoholic beverages
13. Sensory analysis
14. Test

**Literature, handbooks**

János Csapó, Éva Visi Vargáné (2011): Introduction to the Chemistry of Foods and Forages. Digitális tankönyvtár (http://www.tankonyvtar.hu/hu/tartalom/tamop425/0059\_chemistry\_of\_foods/adatok.html)

Péter Sipos (2013): Quality Analysis of Agricultural Products. Digitális tankönyvtár (<http://www.tankonyvtar.hu/hu/tartalom/tamop412A/2011_0009_Sipos_Peter-Quality_Analysis_of_Agricultural_Products/ch04s02.html>)

Bogdanov, S. (2002). Harmonised Methods of the Interantional Honey Commission. Swiss Bee Research Centre. FAM, Liebefeld, CH-3003 Bern, Switzerland

Codex Alimentarius; Directives

**Food chemistry, MTBE7014A**

ECTS Credit Points: 3

28 hour(s) lecture and 174 hour(s) seminar per semester

Type of exam: written exam

Preliminary requirements:Basics of food microbiology, Basics of cellular and molecular biology, Nutritional sciences

**Requirements:**

- for signature: Attendance at lectures is recommended, but not compulsory.

Participation at practice is compulsory. Students must attend the practice classes and may not miss more than three times during the semester. In case a student does so, the subject will not be signed and the student must repeat the course. Attendance at practice classes will be recorded by the practice leader. Being late is counted as an absence. In case of further absences, a medical certificate needs to be presented. Missed practices should be made up for at a later date, being discussed with the tutor. Active participation is evaluated by the teacher. If a student’s behavior or conduct doesn’t meet the requirements of active participation, the teacher may evaluate his/her participation as an absence because of the lack of active participation in class.

Write 5 assignments, and every assignment must be done in time. The plagiarism is not acceptable!

On a selected subject, students must give a Power Point presentation on the seminar. (20 minutes)

During the semester there are 5 mid-term tests, students have to sit for the tests. If the score of the mid-term tests is below 50%, the student can take a retake test once. If the all tests are above 50% the student can take the exam.

The minimum requirement of the mid-term and end-term test is 50%.

Based on the score of the tests separately, the grade for the tests is given according to the following table:

Score Grade

0-49 fail (1)

50-59 pass (2)

60-69 satisfactory (3)

70-79 good (4)

80-100 excellent (5)

If the score of the exam test is below 50, students can take a retake test in conformity with the EDUCATION AND EXAMINATION RULES AND REGULATIONS.

The course ends with a final grade, which will be calculated with the average of the mid-term test and exam result.

- for a grade: Written end-term test.

**Summary of content – theory**

This course provides an advanced knowledge for the audience and the opportunity to get to know the food components. Students get acquainted with the transformation processes taking place in foodstuffs during storage and heat-treatment. They become familiar with the importance of additives and problems connected to them.

**lectures:**

1. Water and Minerals
2. Introduction to Inorganic food analysis
3. Carbohydrates I.
4. Carbohydrates II.
5. Amino Acids and Protein I
6. Amino Acids and Protein II.
7. Lipids I
8. Lipids II.
9. Food Contamination and Safety
10. Vitamins and Organic analysis
11. Food Additives
12. Food Flavoring
13. Food Preservation
14. Summary and exam

**Summary of content - practice**:

The practice related to the actual topic of the lecture. Students learn to carry out complex tasks and literature search in food chemistry topic.

**practices:**

1. Problem solving and tasks in water and minerals topic
2. Demonstration of the Inorganic food analysis
3. First test
4. Problem solving and tasks in carbohydrates topic
5. Second test
6. Problem solving and tasks in amino acids and protein topic
7. Third test
8. Problem solving and tasks in lipids topic
9. Fourth test
10. Problem solving and tasks in food contamination and vitamins topic
11. Fifth test
12. Problem solving and tasks in food additives and food flavoring topic
13. Demonstartion in food preservation topic
14. Presentation of the students

**Literature, handbooks**

Belitz, H.-D.,Grosch, Werner, Schieberle, Peter : Food chemistry, 2009 ISBN 978-3-540-69934-7

John M. de Man: Principles of Food Chemistry Springer, 1995Nutritional Toxicology

**Food colloidics MTBE7012**

ECTS Credit Points: 3

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

Type of exam: written exam

**Requirements:**

- for signature: Giving presentation (10 minutes)

- for a grade: Written exam (minimum 60%)

**Summary of content – theory**

The history of colloid science. Classification and introduction of colloidal systems. Classification and functions of colloidal systems in Food. Types of colloidal system in Food.

**lectures:**

1. The history of colloid science. Colloid systems. Associated colloids, macromolecular colloids.
2. Category of colloid systems.
3. Suspensions, true solutions and colloidal solutions. Optical properties of colloidal systems.
4. Colloidal suspensions I.
5. Colloidal suspensions II.
6. Spray, mist, aerosols.
7. Emulsions.
8. Emulsifiers and stabilizers.
9. Application of emulsions in food industry.
10. Foam and solid foam. Application of foam in the food industry.
11. Hydrocolloids in food industry, the health aspects of hydrocolloids.
12. Hydrocolloids in food industry (agar, starch, gelatin).
13. Hydrocolloids in food industry (carrageenan, furcellaria, xanthan gum).
14. Hydrocolloids in food industry (galactomannans, gum arabic, pectins, milk and egg protein).

**Summary of content - practice**:

Application of different colloid systems in food industries and food stuffs. Calculation method in food colloid science

**practices:**

1. Colloids. Colloid systems
2. Category of colloid systems
3. Suspensions, true solutions and colloidal solutions
4. Colloidal suspensions
5. Colloidal suspensions - Calculations
6. Aerosols
7. Emulsions
8. Emulsifiers and stabilizers
9. Application of emulsions in food industry. HLB calculations I.
10. Application of emulsions in food industry. HLB calculations II.
11. Application of emulsions in food industry. HLB calculations III.
12. Foam and solid foam. Application of foam in the food industry
13. Hydrocolloids in food industry I.
14. Hydrocolloids in food industry II.

**Literature, handbooks**

Cosgrove T.: 2005. Colloid Science, Principles, Methods and Applications. Bristol, UK. Blackwell Publishing Ltd.

Belitz D., Grosch W., Schieberle P.: 2004. Food Chemistry, Springer Verlag.

Ludger O. Figura, Arthur A. Teixeira: 2007. Food Physics, Springer, Heidelberg.

**Food hygiene, MTBE7030A**

ECTS Credit Points: 3

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

Type of exam: written exam

**Requirements:**

- for signature: Attendance at **lectures** is recommended, but not compulsory. Participation at **practice** is compulsory. Students must attend the practice classes and may not miss more than three times during the semester. In case a student does so, the subject will not be signed and the student must repeat the course. Attendance at practice classes will be recorded by the practice leader. Being late is counted as an absence. In case of further absences, a medical certificate needs to be presented. Missed practices should be made up for at a later date, being discussed with the tutor. Active participation is recommended and evaluated by the teacher. All of the students have to keep an oral presentation from a chosen topic at the end of the semester (compulsory).

- for a grade: Keeping a presentation on a chosen topic in connection with food hygiene. Written exam. Anyone, who got a signature is allowed to take the written exam. The written exam consists of 10 questions (10 points each, 100 points all together), with the following Score Grade

0-60 fail (1)

61-70 pass (2)

71-80 satisfactory (3)

81-90 good (4)

91-100 excellent (5)

**Summary of content – theory**

The importance and development of food hygiene has been continuously growing in the last few decades. One of the most important priorities in the European Union is to provide healthy and safe food to the citizens. The aim of this subject is: 1. enable food engineer students to go over the food industry’s judicial and theoretical background. 2. make them realize how big influence animal health has on consumers’ health through foods of animal origin. After the introductory and general lessons, the main topics are milk and meat hygiene. Another further aim of the subject is to present the zoonotic diseases, and the impact of food on the pathogenesis of chronic diseases.

**lectures:**

1. Basic definitions. History of food hygiene.
2. Connection between food hygiene, food health and quality inspection.
3. Food safety and its authorities.
4. Food hygiene regulations. Food-borne diseases.

5. Primary production. Establishing food producing works.

6. General hygienic terms, regulations in food manufacturing.

7. Characteristics of milk and physiology of milk production from the point of view of animal health.

8. Hygienic milking and milk handling. Mastitis, and its impact on milk production.

9. Cleaning and sterilising milking equipment and devices. Milk handling in the farms. Ranking of raw milk.

8. Milk-borne diseases, zoonozes.

9. Definition and attributes of meat, veterinary inspection of meat production.

10. Definition and steps of veterinary meat inspection. Meat-borne human diseases.

11. Animal wellbeing regulations in connection with meat-producing animals and slaughterhouses. Meat inspection of mammals.

12. Septicaemias. Disorders of meat (flavour, colour, texture and smell).

13. Meat inspection in poultry and other animals. Technological hygiene (poultry, rabbit, game animals).

14. Micotoxins. The role of food in pathology of chronic diseases.

**Summary of content - practice**:

The aim of this subject’s practical part is: 1. enable food engineer students to look through the food industry’s practical background. 2. make them realize how big influence the animal health has on the consumers’ health through foods of animal origin. The subject contains several farm, slaughterhouse, food factory visits with the opportunity of examining hygienic production in the primary production and the processing area.

**practices:**

1. Basic agricultural knowledge: primary production (meat and milk)
2. Raw milk and processed milk products’ quality inspection.
3. Animal hygiene from the milk producers’ point of view.
4. Somatic cell and standard plate and coliform number count of the raw milk with Lactoscan combo
5. Raw meat and processed meat quality inspection.
6. Inspection of trichinellosis in meat with a trichioscope.
7. Hygiene of egg production.
8. Egg inspection with a lamp.
9. Farm visit.
10. Farm visit
11. Slaughterhouse visit (poultry)
12. Slaughterhouse visit (mammals)
13. Consultation.
14. Consultation

**Literature, handbooks**

The most important is to make notes during the lessons and practices: exam questions are going to be composed according to the knowledge based on the lectures and practices.

H. L. M. Lelieveld, John Holah, Domagoj Gabric: Handbook of Hygiene Control in the food industry (second edition)

 Yasmine Motarjemi, Huub Lelieveld: Food safety management, a practical guide for the food industry

Jim McLauchlin, Christine Little, Betty C. Hobbs: Food poisoning and food hygiene, seventh edition

Neelam Khetarpaul: Food microbiology

**Food Industry Economics MTBE7025A**

ECTS Credit Points: 3

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

Type of exam: oral and written exam

**Requirements:**

- for signature: The students shall write a test in the last week of the semester. The prerequisite of the signature of the course is that the score of this test reaches, or exceeds 60% of the maximum score. Another prerequisite of the signature is the submission of a case study and the oral presentation of the own-made study of a given field of food industry enterprise, with the pre-given content till the deadline (the end of the 8th -10th week of the semester). The head of the course will refuse to sign the course if each of the three above-mentioned requirements is unsuccessful (e.g. in case of absence from the oral presentation, or overrun of deadline).

- for a grade: Written and oral (test and case study presentation)

**Summary of content – theory**

The students have to be familiar with the economic basis of processing, storage and conservation of agricultural products. Organization and public administration of the food industry, competitiveness and market performance. The key issues of EU food trade. Innovation trends in food industry. The situation, regulation and competitiveness of the food industry. The basis of agri-food marketing (AM).

**lectures:**

1. The importance and the role of the food economy, its position in the national economy
2. The evolution of food processing industry, characteristics.
3. The economic environment of food economy and food politics.
4. The key issues and market performance of the EU food policy an food trade
5. Innovation trends in the food industry.
6. The structure and the competitiveness of food sector
7. The basic principles of Hungarian food policy
8. Regulatory bodies in Hungarian Food Policy
9. The structure of business plan of food industry enterprises
10. Vertical and horizontal integration in the food industry sector.
11. Food industry logistics
12. Trends and the characteristics of food consumption in the world food economy.
13. The characteristics and situation of food trade sector.
14. The basic principles of Agricultural and Food Marketing
15. The main characteristics of Hungaricum Club

**Summary of content - practice**:

The structure of business plan of food industry enterprises.

**Literature, handbooks**

J.H.M. Wijnands- B.M.J. van der Meulen-K.J.Poppe (2007): Competitiveness of the European Food Industry. Landbouw Economic Institute. The Hague.

Chester O. McCorkle (Ed.)(1988): Economics of Food Processing in the United States.

Wierenga B, Grunert K, Steenkamp JBEM, Wedel M, van Tilbur: Agricultural Marketing and Consumer Behaviour in a Changing World. Kluwer Academic Press. 1-337 p. (ISBN 978-079239-856-1)

W. B. Trail – E. Pitts. (1997): Competitiveness in the food industry. Blackie Academic  Professional. London. 1-299 p. (ISBN 0751404314)

W. B. Trail - K.G.Grunert (1997): Product and Process Innovation in the Food Industry. Blackie Academic and Professional. London. 1-231 p. (ISBN 0751404241)

M.D. Ranken R.C. Kill, C.G.J. Baker (1997): Food industries Manual. Blackie Academic and Professional. London. 1-312 p. (ISBN 0751404047).x

**Food industry technologies and quality assurance MTBE7031A**

ECTS Credit Points: 3

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

Type of exam: oral exam

**Requirements:**

- for signature: Successful test (60%) and participation in practices

- for a grade: Completing exercises, submitting individual project task, successful test.

**Summary of content – theory**

The main aim of the lectures is to know the hygiene requirements in relation to plant origin food production, the structure of HACCP plan and the methodology of hazard identification, hazard analysis, flow diagram preparation and corrective action determination. By the end of the semester, students will be able to identify physical, chemical and microbiological hazards in plant origin food production, and they will be able to prepare a HACCP plan.

**lectures:**

1. Food hygiene (852/2004/EC regulation) and HACCP system
2. Methodology of determination of hazards and making a flow diagram
3. Methodology of hazard analysis and determination of PRPs, oPRPs and CCPs
4. Methodology of monitoring procedures and corrective actions
5. Technologies and hazards in the production of non-alcoholic drinks
6. Technologies and hazards in the production of bakery products
7. Technologies and hazards in the production of confectionery products
8. Technologies and hazards in canned food production
9. Technologies and hazards in quick-frozen foodstuff production
10. Technologies and hazards in pickles production
11. Technologies and hazards in vegetable oil production
12. Technologies and hazards in the production of alcoholic beverages (beer)
13. Technologies and hazards in the production of alcoholic beverages (wine)
14. Test

**Summary of content - practice**:

The main aim of the practices is to increase the knowledge of HACCP plan and hazard analysis. For this purpose, the preparation of HACCP plan (mainly hazard analysis) will be carried out for concrete foodstuffs, and the students will make an individual project task about a chosen food.

**practices:**

1. 2016/C 278/01 regulation
2. Determination of hazards and preparation of flow diagrams
3. Preparation of hazard analysis and determination of PRPs, oPRPs and CCPs
4. Description of monitoring procedures and corrective actions
5. Hazard analysis of 100% natural apple juice production
6. Hazard analysis of bread production
7. Hazard analysis of biscuit production
8. Hazard analysis of canned peach production
9. Hazard analysis of quick-frozen French fries production
10. Meeting about the individual project task
11. Hazard analysis of spiced oil production
12. Hazard analysis of beer production
13. Hazard analysis of fruit wine production
14. Group presentation of the project task

**Literature, handbooks**

2016/C 278/01 EU Commission notice on the implementation of food safety management systems covering prerequisite programs (PRPs) and procedures based on the HACCP principles, including the facilitation/flexibility of the implementation in certain food businesses

852/2004/EC regulation

Lelieved, H., Holah, J., Gabric, D.: (2016): Handbook of Hygiene Control in the Food Industry. ISBN: 978-0-08-100197

Codex Alimentarius Commission: Food hygiene. Basic texts. (http://www.fao.org/docrep/012/a1552e/a1552e00.pdf)

**Food microbiology MTBE7024A**

ECTS Credit Points: 4

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

Type of exam: written exam

**Requirements:**

- for signature: Participating in the courses, completing practical exercises

- for a grade: Three mid-year written exams, written exam (if the result of the mid-year written exams is less than 60%). The course ends in a mid-semester grade based on the result of the mid-year written exams. The minimum requirement for both mid-term and end-term written exams is 60%.

Result and grade:

0-59%: fail (1)

60-69%: pass (2)

70-79%: satisfactory (3)

80-89%: good (4)

90-100%: excellent (5)

If the result of the written exams is below 60%, it is necessary to rewrite that.

**Summary of content – theory**

The aim of the subject is the introduction of the subject, task and history of food microbiology, internal and external factors that influence the safety and quality of raw materials and finished products. Students will also learn about the most important microbiological contaminants of the food, the major preservation methods, furthermore, about the disease and spoilage causing microorganisms.

**lectures:**

1. The subject, task and history of food microbiology
2. Microbial ecology of food. Sources of contamination
3. Characteristics of microorganisms. The inherent characteristics of food
4. External environmental factors. Interactions of ecological factors
5. Growth and destruction of microorganisms
6. Diseases caused by food (food infection, food poisoning)
7. Food borne pathogens
8. Mycotoxin-producing moulds, mycotoxins
9. Preserving operations. Heat treatment, heat removal, dehydration, radiation
10. Chemical and combined preservation methods
11. Food-fermentation. Useful microorganisms
12. Indicator and spoilage microorganisms
13. Microbiology of plant products
14. Microbiology of animal products

**Summary of content - practice**:

Skills to be learnt: to know the main microbiological methods, which are used in a food microbiological laboratory.

**practices:**

1. Sampling and transport of food samples
2. Determination of all cell counts using Thoma cell counting chamber
3. Preparation of agar media
4. Examination of total aerobic plate count of feed sample with plate count method
5. Examination of Enterobacteriaceae count of meat products with plate count method
6. Examination of coliform bacterium count of water sample with membrane filtration method
7. Examination of staphylococci count in raw milk samples with spread plate method
8. Detection and enumeration of Enterobacteriaceae count of dairy product by MPN technique
9. Examination of yeast and mould count in frozen products with spread plate method
10. Oxidase test in case of an isolated bacterium
11. Catalase test in case of an isolated bacterium
12. Monitoring the surface hygiene with swab methods using poured plates
13. Measurement of the size of yeast cells under light microscope
14. Mid-year written exam

**Literature, handbooks**

Karaffa, E. – Peles, F. (2015): Microbiological aspects of food quality and safety. University lecture notes. University of Debrecen. TÁMOP-4.1.2.D-12/1/KONV-2012-0008. 110p.

Doyle, M.P. - Buchanan, R.L. (2013): Food Microbiology: Fundamentals and Frontiers. 4th edition. ASM Press, Washington. 1118p.

Adams, M.R. - Moss, M.O. (2008): Food Microbiology. 3rd edition. RSC Publishing. 478p.

**Food Physics MTBE7003A**

ECTS Credit Points: 4

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

Type of exam: colloquium

**Requirements:**

- for signature: Attendance at lectures is not compulsory, but highly recommended!

As an individual activity, all of the students have to complete and present to the other students two power point presentations. The theme of it will be jointly decided by the student and the lecturer. Form and content of presentations will be discussed by the group members, and will be accepted or denied. The denied presentation must be repeated. Requirement to get signature is two accepted .ppt-presentations.

- for a grade: Oral and/or written exam

**Summary of content – theory**

Acquisition of the physical bases of the processes that determine the production and quality assurance of foods and raw materials, their scientific foundation, and the understanding of the physical bases. Developing skills to accommodate new knowledge.

Education of selected food physical knowledge, grounding of further studies, and the foundation of related primer and subject areas.

**lectures:**

1st week: Structure, composition and contents of subject Food Physics. Basic knowledges: systems and environment, phases, components. Dimensions and prefixes.

2nd week: Physical characterisation of water. Functions of water in biological systems. Water content of different ground materials of foods. Definition of phenomenon water activity. Connections between food’s water activity and shelf life.

3rd week: Sorption studies: definition of absorption, adsorption, biosorption, desorption, adsorbent, adsorptivum, adsorbatum, adsorption capacity, adsorption saturation, liophile adsorbent, liophobe adsorbent, liosorption, chemosorption.

4th week: Definitions of mass and density. Density influencing factors. Connection between density and particle size in the case of solid stages.

5th week:Solid state. Crystal grid types and errors. Solutions, solubility. Hydration heat, dissolving heat. Liquid state, surface tension, critical parameters. Vapour tension. Gaseous stage, ideal and realistic gases, gas laws.

6th week: Rheological properties – elasticity, plasticity and flow behaviours. Influencing factors: temperature, pressure. Energy and time demand at the flowing of elastic and plastic systems. Tixotripy, changing of movement characteristics.

7th week: Phenomenon of surface tension of fluids: reason, definition, dimension, measurement methods.

8th week: Definition, measurement methods and calculation of permeability of plain sheet shape materials.

9th week: Thermal properties. Temperature scales: Celsius, Fahrenheit and Kalvin. Calorimetry, measuring the potential energy level of foods. Basic principles of thermodynamic. Physical and energetic background of operation of refrigerators and deep freezers. Using the heat energy of the freezer’s warm side.

10th week: Caloric values of foods. Thermal analysis of different foods: TA, DTA, TG and DTG methods and evaluation of the diagrams.

11th week: Electronical and electrical properties. Electro conductivity, capacity and electrolity solutions. Operations of galvanic elements and batteries. Redox systems, redox potential and their role in foods. Local elements and their use in corrosion protection.

12th week: Magnetic properties: diamagnetic, paramagnetic and ferromagnetic characters. Nuclear magnetic resonance and its analytical use for foods.

13th week: Optical properties of systems. Refraction index, colorimetry. Light absorption of solvents.

14th week: Basic knowledges of radioactivity. Alpha, beta and gamma radiations. Generating of X-ray radiation. Energy of radioactive radiations, ionizing radiations. Irradiation of foods by ionizing radiations.

**Summary of content - practice**:

Deeping the theoretical knowledges by solving some practical exercises. To get adequate skills of discussing the lecture’s material. Basic practical knowledges on the really wide range of possibilities of Food Physics.

**practices:**

1st week: Possible connections between systems and environment: open, closed and isolated systems. Homogenous, heterogenous and inhomogenous systems. Categorising of living organisms by the given aspects

2nd week: Methods for calculation of food’s water activity values. Connections between food’s water activity and shelf life.

3rd week: Comparing of existing adsorption models: Freundlich, Langmuir and BET models, theoretical and practical differences of the models. Absorption and adsorption influenced by temperature, pressure and solution concentration. Using adsorption and subsequent adsorption for separation of components.

4th week: Calculation of density by systems in different phases. The main density influencing factors.

5th week: Phase parameters: volume, pressure, temperature. Energy level modification during phase change. Phase diagram of water and dilute solutions.

6th week: Comparison of rigid, elastic and plastic rheological stages. Changes of energy demand for moving of plastic systems.

7th week: Importance of surface tension of liquid stage foods, fruit juices and alcohol containing beverages.

8th week: Permeability calculations for different food packaging materials. Permeability influencing during the production of packaging materials.

9th week: Physical, chemical and phase transition heats. Enthropy, enthalpy – definitions and demonstrations. Procedure direction influencing factors.

10th week: Calorimetric calculations of foods digestion, usable energy, digestion energy and sum of energy. Energy efficiency.

11th week: Electrical conductivity calculations of electrolyte solutions: phenomenon of eletrolytical dissociations.

12th week: Demonstration of diamagnetic, paramagnetic and ferromagnetic characters of systems – their usability in the practice

13th week: Analysis with the measurements of UV, VIS and IR light absorption spectrum. Lambert-Beer’s low.

14th week: Using of ionizing gamma and X-ray radiations for the shelf-life extension of foodstuffs. Acceptance of this method by the wide range of the food consuming populations.

**Literature, handbooks**

***Compulsory literature:***

Figura, L.O. – Teixeria, A.A. (2007): Food Physics. Physical properties – Measurement and Application. Springer Verlag, Berlin-Heidelberg-New York. ISBN-13: 978-3-540-34191-8

***Optional literature:***

Figura, L.O. (2004): Lebensmittelphysik. Physikalische Kenngrößen – Messung und Anwendung. Springer Verlag, Berlin-Heidelberg-New York. ISBN-10: 3-540-20337-0

**Food Process Control Systems MTBE7042A**

ECTS Credit Points: 3

14 hour(s) lecture and 147 hour(s) seminar per semester

Type of exam: practical course mark

**Requirements:**

- for signature: Attendance at lectures is not compulsory, but highly recommended. Maximum 3 absences are allowed from seminars.

- for a grade: Oral and/or written exam

Preliminary requirements: Measurement techniques and automatization

**Summary of content – theory**

The aim of the course is to broaden the knowledge of food engineering students about the control systems, to expand the basic automation knowledge in the field of the elements and operation of systems used in the food industry. During the semester, they get acquainted with the structure and programming of PLC systems and gain insight into the modern electronic and IT possibilities that can be used to manage, monitor and document production, learn the logic of these systems, which enables their use in practice and development.

**lectures:**

1. Grouping and basic structure of process control systems
2. Basics of PLC programming, application of binary logic in practical tasks
3. Types, grouping and comparison of programming languages
4. Basics of instruction line and ladder diagram programming
5. Program plans for simple controls
6. Sequential control, branches
7. Food business control examples
8. General characterization of microcontrollers, their grouping, application possibilities, their integration into other networks
9. General structure of microcontroller systems, matching of sensors and actuators
10. Programming microcontrollers I
11. Programming microcontrollers II
12. User interface integration, hardware and software connection
13. Connection of control system to cloud based systems, data archiving, network integration
14. Food and laboratory applications

**Literature, handbooks**

Ferenczi István 2018: PLC programozási alapismeretek. Nyíregyházi Egyetem, ISBN 978-615-5545-78-8

Hegedűs József: Programozás létradiagramos programozási nyelven Nemzeti Szakképzési és Felnőttképzési Intézet

Harsányi Réka - Juhász Márton András (2014): Fizikai számítástechnika: elektronikai alapok és

Arduino programozás. Typotex Kiadó ISBN 978 963 279 189 0

**Functional foods MTBE7040A**

ECTS Credit Points: 3

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

**Requirements:**

- for signature: 80% participation in the lectures and in the practice

- for a grade: Submitting essay

**lectures:**

**1. Introduction. Basic concepts.** Definitions. What makes a food functional? Physiological effects of functional foods. How to produce functional foods? Consumer expectations in connection with functional foods. Food safety and functional foods. Functional foods and legislation.

**2. Producing functional foods with fortification 1.** Basic concepts. Fortification of the functional components of foods. Substitution of the components of foods. Supplementation. Fortification of foods with vitamins and minerals. The necessity for fortification. Iron deficiency and its consequences. Iodine deficiency and its consequences. Vitamin A deficiency and its consequences. Zinc deficiency and its consequences. Calcium deficiency and its consequences. Folic acid deficiency and its consequences. Fortification of foods with vitamins.

**3. Producing functional foods with fortification 2.** Fortification of foods with polyphenols. The properties of polyphenols. The technological aspects of making plant extracts. Fortification of foods with carotenoides. Fortification of foods with oils containing essential fatty acids. Polyunsaturated fatty acids. Biological effect of polyunsaturated fatty acids. The sources of polyunsaturated fatty acids. Conjugated linoleic acids. Technological aspects connected to lipids. The oxidation of lipids during the manufacture of fish oil and microalgae oil. The refining of fish oil. The fortification of the foods with biologically active lipids. Examples for the fortification of CLA, sterols and PUFA-s in foods. Enhancing the effectiveness of functional food components. Beauty care functional foods. Flavonoids, as components of functional foods. The structure of the flavonoids. The grouping of flavonoids. The intake of flavonoids into the body by foods.

**4. The bioactive components in milk and their production 1.** The bioactive components in milk. Bioactive proteins. The biological effects of main milk proteins and their application. The application of whey proteins in industry and trade. The production of bioactive peptides and their functionality. Bioactive peptides and innovative applications. The bioactive peptides and their activity in dairy products. Dairy products and additives containing bioactive peptides.

**5. The bioactive components in milk and their production 2.** Bioactive lipids. Conjugated linoleic acids (CLA). The increase of the quantity of CLA. The fatty acid content, KLS content and their change during the lactation. The influence of the different microorganism cultures for fatty acid and CLA composition of dairy products. The CLA content of butter, cheeses and margarine. The changes of the CLA content of different cheeses during storage. Polar lipids. Factors affecting growth. Other bioactive compounds in milk. Exopolysaccharides (EPS) and oligosaccharides produced by lactic acid bacteria. Determination of the structure and measurement of the quantity of EPS produced by different lactic acid bacteria. The possibilities to produce galactose oligosaccharides (GalOS) in industrial scale. The determination of the quantity and structure of EPS-s. The monosaccharide composition of EPS-s. The chemical modification and structure research of EPS-s. Summary of the bioactive components in milk.

**6. Prebiotics, probiotics, symbiotics.** Basics related to probiotics. Probiotics and their basic characteristics. The scope of prebiotics and their basic characteristics. The micro flora of the human digestive system. The germ number. The different germs and their proportion. Causes for the modification of the gut flora. The possibilities for the modification of the gut flora. The current probiotic cultures and their determined requirements. The probiotic phylums developed by Hungarian researchers. The basic principles of probiotic uptake. The uptake of probiotics by dairy products. The uptake of probiotics with dietary supplement in capsule form. The benefits of probiotics. Summary of the more important human physiological benefits of probiotics.

**7. The role of the meat in nutrition and in health protection.** The proteins of the muscle tissues. Water soluble proteins. Insoluble proteins. Biogenic amines. Creatine and creatinine. Meat maturation. Quality failures occurring in the case of pork. The meat, as functional food. The meat as protein source. The meat as fat source. The fat and cholesterol content of meats. The fatty acid composition of the different fats and fish oil. The meat as source of vitamins. The meat as source of mineral materials. Unprocessed meats. Slice, soups and goulash meats. The pork in culinary use. Protein products. Additives. Product groups in meat industry. Digestibility of meats. The meat and the allergy. Delightful effect.

**8. The soya as functional food 1.** The conformation of the quality of soya proteins during processing. The influence of the oxidation for the damage of the proteins. The influence of heat for the damage of proteins. Reactions in the side chain of the amino acids and between protein molecules. Influence of the basic treatment. Reactions between proteins and carbohydrates. Reactions between proteins and lipids. Connection between proteins and polyphenols.

**9. The soya as functional food 2.** The demonstration of the heat damage of soya proteins. Technologies influencing the protein quality. Antinutritive and toxic materials influencing the utilization of the protein. Heat resistant antinutritive materials in soya. The elimination of the effect of the antinutritive materials in soya. Examinations suitable for the qualification of soya protein. Some chemical methods for the determination of the quality of protein. The complex qualification of soya proteins.

**10. Foods supplemented with selenium.** In general about selenium. Selenium as an essential microelement. The different forms of selenium in the living world. The antioxidant properties of selenium. Enzymes with selenium content. The utilization of selenium. The selenium content of foods of plant origin. Foods supplemented with selenium. The selenium content of plants. The accumulation of selenium. Selenium species in the biosphere. Selenoaminoacids. Selenium deficiency and its prevention. Enrichment with selenium. The total selenium-, seleno methionine- and organic selenium content of wheat grass and seed. Edible sprouts enriched with selenium. Edible sprouts with high selenium content in the prevention of cancer. Supplementation of the foods with selenium. Egg supplemented with selenium. Milk and dairy products supplemented with selenium. Selenium content of the dairy products made from high selenium content milk.

**11. The egg and lipids as functional food.** The egg yolk. The egg whites. Egg colouring materials. Changes during the storage of egg. Important characteristics of egg base products. Dried egg based products. **Lipids of plant and animal origin.** Lipids of plant origin. Lipids of animal origin. Lipids from marine animals. Factors affecting the quality of fats and oils.

**12. Cereals, vegetables and fruits as functional foods.** Cereals. The composition of the cereals. The carbohydrate content of the cereals. The proteins of the cereals. The protein components and the structure of wheat gluten. The lipid content of cereals. Processing of cereals. Enzymes playing role in processing of cereals. Thiol components of wheat flour. Baking tests. The influence of ascorbic acid on the pasty production in the case of wheat flour. The influence of the added wheat flour with lipoxigenase enzyme activity on the wheat flour. The influence of the added cysteine on the wheat flour. The influence of the added α-amylase on wheat flour. The influence of the emulsifiers and fats. Vegetables and fruits. Vegetables. The composition of vegetables. Flavouring substances. The vitamin content of vegetables. Pigments of plant origin. The shelf life of vegetables. Fruits.

**13. Edible sprouts as functional foods.** The significance of sprouts in nutrition. Biochemical changes during sprouting. Sprouts enriched by selenium. The utilization of the selenium. Our own investigations in relation to the sprouts.

**14. The red wine as functional food.** The chemical composition of grape, must and wine. The biochemistry of grape maturation. Accumulation of the sugar in the berry. The determination of the maturity. The structure and composition of the cluster of grapes. The chemical composition of the must. The biochemistry of fermentation. The chemical composition of wine. Alcohols. Sugars, organic acids, volatile acids, phenolic components. Possibilities of the objective determination of the colour of red wines. The nitrogen containing materials of the wine. Pectins and polysaccharides. Aromatic components in wine. Polyphenols in aroma production. Components causing typical taste failure in wine. Vitamins in wine. The chemistry of wine development. Oxidation-reduction phenomena in wine. Aromatic components produced during storage and maturation of wine. The red wine as functional food. The health protection role of wine. The effects of moderate red wine consumption.

**Literature, handbooks**

Ghosh, D. – Das, S. – Baghchi, D. – Smarta, R.B.: Innovation in healthy and functional foods. CRC Press, Taylor & Francis Group, 2013. 1-598.

Kanekanian, A.: Milk and dairy products as functional foods. Wiley Blackwell, 2014. 1-406.

Kristbergsson, K. – Ötles, S.: Functional properties of traditional foods. Springer Science+Business Media, New York, 2016. 1-369.

Noorhorm, A. – Ahmad, I. – Anal, A.K.: Functional foods and dietary supplements. Processing, effect and health benefits. Wiley Blackwell, 2014. 1-527.

Ottaway, P.B.: Food fortification and supplementation. Technology, safety and regulatory aspects. Woodhead Publishing Limited, 2008. 1-297.

Shi, J. – Mazza, G. – Le Maguer, M.: Functional foods. Biochemical and processing aspects. CRC Press, 2002. 1-542.

Shi, J.: Functional food ingredients and nutraceuticals: Processing technologies. CRC Press, Taylor & Francis Group, 2016. 1-681.

Smith, J. – Charter, E.: Functional food products development. Wiley Blackwell, 2010. 1-537.

**General and Inorganic Chemistry MTB7006A**

**Name and title of the person responsible for the subject:** Dr. Béni Áron, associate professor

**Additional instructors involved in teaching the subject:** Erdeiné Dr. Kremper Rita, assistant professor;

**Name and level of the program:** Food Engineering BSc

**Subject type:** obligatory

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

**Credit value of the subject: 4**

**Purpose of teaching the subject:** Learning the basics of "General and inorganic Chemistry" for related subjects

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

Week 1-2: Material and structure. Material systems. Parts of the atom. The structure of the nucleus. Atomic models. X-rays. Quantum numbers, orbital energy, nuclear orbital charge, Pauli principle and Hund rule. Periodic Table. Nuclear trunk, valence shell. Ionization energy, electron affinity, electronegativity. Size of atoms and ions and their change in the periodic table.

Week 3-4: Structure of molecules. Primary chemical bonds, binding and loosening molecular pathways. Sigma and pi binding. Hybridization. Secondary chemical binding forces. Geometry and polarity of molecules. Order of binding. Complexes, chelates. Clathrates; detection of starch in foodstuffs.

Week 5: Complex material systems. Material sets. Solid state. Crystal lattice types. Solutions, solubility. Heat of hydration, heat of dissolution. Liquid and gaseous state, gas laws.

Week 6: Mixtures, solutions, electrolytes. Ways of expressing the concentration of solutions. Dilute solutions and their properties.

Week 7: Reaction kinetics. Direction of chemical processes, time course, factors influencing reaction rate. Catalysis, catalysts.

Week 8-9: Protolytic processes. Major acid-base theories. Law of mass effect. Dissociation of weak acids and bases. The concept and interpretation of pH. Hydrolysis of salts. Indicators, buffers. Solubility product of salts. Stability of complex ions.

Week 10: Electrochemistry. Oxidation number. Electrolysis, Faraday's laws. Electrode, normal and standard potential. Hydrogen electrode. Galvanic cells. Redox systems, redox potential. Local elements.

Week 11: Colloids. Colloidal systems, specific surface area of colloids. Properties of colloidal solutions, adsorption. Stability of colloids. Gels.

*Inorganic chemistry*

Week 12: Distribution of elements by frequency and property. Non-metallic elements: Hydrogen. Halogen elements and their compounds. Oxygen group elements. Sulfur and its compounds. Nitrogen group elements. Nitrogen and its compounds.

Week 13: Phosphorus and its compounds. Elements of a carbon group. Carbon and inorganic compounds. Silicates. Boron and its compounds.

Week 14: Metallic elements: Alkali metals, alkaline earth metals and their compounds. Water hardness, water softening. Natural waters. Properties and compounds of aluminum. Elements and major compounds of the zinc group. Elements and major compounds of the manganese group.

**Type of mid-term examination:** Report on laboratory exercises and written tests

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

**Teaching aids:** ppt

**Recommended literature:**

P. Atkins, L. Jones, L. Laverman (2016) “Chemical Principles: The Quest for Insight”. 7th edition. Publisher W.H. Freeman and Company. ISBN 1464183953

**Industrial microbiology,** **MTBE7019A**

ECTS Credit Points: 3

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

Type of exam: Written exam

**Requirements:**

- for signature: participation at the practice

- for a grade: Written exam

**Summary of content – theory**

Based on biochemical and microbiological studies, the general objective of the subject is to provide more detailed knowledge about the biochemical and physiological processes of "industrial" micro-organisms used in biotechnology. The course covers the technical and technological basics of industrial microbiology, the most important operations and processes, and the qualitative and quantitative relationships between them.

**lectures:**

1. Basic principles of microbiology. Introduction - Microorganisms and microbiology. A short journey in the world of microbes. Cell structure of prokaryotes and eukaryotes.
2. Phylogenetics and characteristics of industrial microbes.
3. Protein synthesis: amino acids, DNA and RNA processes.
4. Molecular biology / bioinformatics in biotechnology: PCR, qPCR, sequencing.
5. Molecular biology / bioinformatics in biotechnology: microarrays, databases.
6. Industrial fermentation media. Qualitative and quantitative characteristics of the medium. Water, carbon source, nitrogen source, phosphorus, sulphur, potassium, sodium, other ions, trace elements, vitamins, supplements.
7. Isolation, maintenance and development of industrial microorganisms.
8. Basics of fermentation. History of fermentation.
9. Upstream Processing: Engineering basics, unit operation.
10. Fermentation analytics. Basic elements of the control systems. Fermentation parameters: temperature, pH, stirring rate, dissolved oxygen content and redox potential of the medium, air flow rate, gas balance of inlet and outlet air, reactor current consumption and weight, pressure inside the reactor, degree of foaming.
11. Downstream processing. Extraction of extracellular product. Removal of solids and microorganisms. Filtration, centrifugation, precipitation. Recovery of intracellular products. Cell disruption.
12. Industrial Microbiological Products I. Biology and technology of the production of amino acids (L-lysine, L-glutamic acid, L-threonine).
13. Industrial Microbiological Products II. Biology and technology of fermentation production of organic acids (citric acid, itaconic acid, gluconic acid, lactic acid, acetic acid).
14. Industrial Microbiological Products III. Fermentable antibiotics.

**Summary of content - practice**:

Skills to be learnt: the technical and technological basics of industrial microbiology, the most important operations and processes, and the qualitative and quantitative relationships between them.

**practices:**

1-4: Structure, assembly and sterilization of different types of fermenters

5-10: Monitoring and control of fermentation processes.

11-14: Addition of fermentation: harvesting fermentation, separation of cells and fermentation media, product extraction

**Literature, handbooks**

Nduka Okafor, Benedict C. Okeke: Modern Industrial Microbiology and Biotechnology, CRC Press, 2nd edition, 2018. ISBN: 9781138550186.

Michael T. Madigan, John M. Martinko, David A. Stahl, David P. Clark: Brock Biology of Microorganisms, Benjamin Cummings, 13th edition, 2012.

Pirt JS: Principles of Microbe and Cell Cultivation. Blackwell Scientific Publications, Oxford, UK, 1975

Stanbury PF, Whitaker A: Principles of Fermentation Technology, Pergamon Press, Oxford, UK, 1984

**Informatics, MTB7008A**

**Name and title of the person responsible for the subject:** Dr. László Várallyai, associate professor

**Additional instructors involved in teaching the subject:** Dr. Ádám Péntek, assistant lecturer

**Name and level of the program:** Food Engineering BSc

**Subject type:** compulsory

**Teaching timetable of the subject, type of examination**: 0+2 G

**Credit value of the subject:** 3

**Purpose of teaching the subject:** The course is designed to reach a basic level of business informatics knowledge. These knowledge will help them in the following courses and as well as in the practice. They have to learn how to collect data from the internet, and they have to solve complex exercises with the use of Office program family. The course is mainly application and practice oriented

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

1. The use of spreadsheet: basic, formatting, data format
2. The use of spreadsheet: links, (SUM, COUNT, MIN, MAX, AVERAGE)
3. The use of spreadsheet: logical operators (IF, AND, OR); Search functions (VLOOOUP, INDEX, MATCH).
4. The use of spreadsheet: Matrix functions.
5. The use of spreadsheet: Pivot tables
6. Database : Creation of relation tables, the role of keys.
7. Database creation, sheet, form creation.
8. Database queries (QBE, SQL).
9. Database creation (action-oriented)
10. Database forms and subforms creation
11. Database report creation.
12. Independent practical problem solving, task presentation I.
13. Independent practical problem solving, task presentation II.
14. Independent practical problem solving, task presentation II..

**Type of mid-term examination:**

The students get theoretical basic knowledge on the practices. The students get presentations on the parctices get spreadsheets and database knowledge tasks.

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

Participation at practices is mandatory. For the completion of the semester students have to pass a problem solving practical test during the semester. 50% Excel practical exam, 50% Database practical exam

The sum of points the notes are the followings:

0 - 60 % fail,

61 - 70 % pass,

71 - 80 % satisfactory,

81 - 90 % good,

91 - 100 % excellent.

**Teaching aids:**

practical tasks

**Recommended literature:**

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.

**Instrumental analytics MTBE7020A**

ECTS Credit Points: 4

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

Type of exam: written exam

**Requirements:**

- for signature: Participate in the practices and successful practice tests.

- for a grade: Written exam (minimum marks when percentage is 60%).

**Summary of content – theory**

The basic objective of the course is to acquaint students with the most important instrumental chemical analytical knowledge required to determine the quality and components of food, food raw materials and food ingredients.

**lectures:**

 1: Introduction, history of analytical chemistry.

 2: Basic concepts in analytical chemistry, the process of analysis, the accuracy and forms of the results, basic statistical concepts, validation of measurement methods.

 3: Classical methods of qualitative analysis, typical reactions, flame colouring and other methods.

 4: Basic physical measurements in analytical chemistry. Mass, volume, density, conductivity and pH.

 5: Classical analytical measurement methods. Precipitation based on classical analytical methods, gravimetry. Titrations.

 6: The volumetric methods of analysis and their groups. Acid-base titrations. Complexometric titrations. Redox titrations.

 7: The UV/VIS photometry. Apparatuses, methods and applications. Infrared spectroscopy.

 8: Flame photometry (FES). Flame atomic absorption spectrometry (AAS). Graphite furnace atomic absorption spectrometry (GF-AAS).

 9: Inductively coupled plasma optical emission spectrometry (ICP-OES).

10: Chromatographic methods principles, classification, fields of application.

11: GC and HPLC methods, apparatuses, fields of application.

12: Mass spectrometry, mass spectrometry coupled systems (GC-MS, HPLC-MS, ICP-MS)

13: Comparing of analytical methods.

14: Sample preparation methods.

**Summary of content - practice**:

Learning to use the various instrumental chemical analytical techniques to determine the quality and components in various samples of food, food raw materials and food ingredients.

**practices:**

1: Calibration

2 and 3: Performance characteristics

4 and 5: UV-Vis spectrophotometric method

6 and 7: Conductometry

8: Thin layer chromatography

9 and 10: High performance liquid chromatography

10 and 11: Analysis of capsaicin and dihydrocapsaicin contents

12: Sample preparation for elemental analysis

13: Flame atomic absorption spectrometry

14: Inductively coupled plasma optical emission spectrometry

**Literature, handbooks**

Boss, C. B. & Fredeen, K. J., 1997. Concepts, instrumentation, and techniques in inductively coupled plasma optical emission spectrometry. Perkin Elmer. USA.

Cresser, M. S., 1994. Flame spectrometry in environmental chemical analysis. The Royal Society of Chemistry. Cambridge.

Montaser, A. & Golightly, D. W., 1987. Inductively coupled plasmas in analytical atomic spectrometry. VCH Publishers. New York.

Montaser, A. 1998. Inductively coupled plasmas mass spectrometry. VCH Publishers. New York.

Pare J.R.J. and J.M.R. Belanger, 1997. Instrumental methods in food analysis. Environment Canada, Environmental Technology Centre, Ottawa, Ontario, Canada, Elsevier, Amsterdam - Lausanne - New York - Oxford - Shannon - Tokyo.

Heftmann E., 1992. Chromatography, fundamentals and applications of chromatography and related differential migration methods. Part A: fundamentals and techniques. Elsevier, Amsterdam - Oxford - New York - Tokyo.

**Introduction to food safety MTBE7004A**

ECTS Credit Points: 3

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

Type of exam: written exam

**Requirements:**

- for signature: Participation in lectures according to Rules and Regulations of UD.

- for a grade: written exam

**Summary of content – theory**

The main aim of this course is to know the organisations, regulations and requirements, which are aimed at the production of safe food. Students will know the methodology of hazard analysis and risk assessment of chemical and microbiological hazards.

**lectures:**

1. Influencing factors of food safety
2. Regulations and standard relation with food safety
3. Labelling of food, quality schemes, geographical indicators
4. Introduction to toxicology
5. Vulnerable groups
6. Chemical hazards (toxic metals, animal and plant toxins, other toxins)
7. Microbiological hazards (bacteria, parasites)
8. Test 1
9. Foodborne diseases
10. Introduction to risk management
11. Methodology of chemical risk assessment
12. Hazards of GM plants and GM foods
13. Risk communication; INFOSAN
14. Test 2

**Literature, handbooks**

1169/2011/EU regulation: Regulation No 1169/2011 of the European Parliament and of the Council on the provision of food information to consumers

Hungary – 2016 Report on trends and sources of zoonoses (2016): Trends and sources of zoonoses and zoonotic agents in foodstuffs, animals and feeding stuffs

INFOSAN activity report 2016-2017. Geneva: World Health Organization and Food and Agriculture Organization of the United Nations

**Introduction to microbiology, MTBE7016A**

ECTS Credit Points: 3

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

Type of exam: practical course mark

**Requirements:**

- for signature: Participating in the exercises / Completing practical exercises

-for a grade: Participating in the exercises/ Completing practical exercises Mid-year written exam /Written exam

**Summary of content – theory**

Within the course, students will learn about the structure, metabolism, and genetics of microbial cells. The evolution of microbes, the prokaryotes and the main phylogenetic groups of eukaryotic microbes and their characteristics are described. We present the ecological, environmental, food, biotechnological role of microbes, plant, animal and human diseases.

**lectures:**

1. Microorganisms and Microbiology
2. Brief History of Microbiology
3. Cell Chemistry
4. Metabolism
5. Microbial Growth
6. Environmental effects of microbial growth
7. Molecular Biology of Microorganisms – Genes and Replication
8. Molecular Biology of Microorganisms –Transcription
9. Molecular Biology of Microorganisms – Translation
10. Protein synthesis
11. Microbial Evolution and systematics
12. Taxonomy of the Prokaryotes
13. Taxonomy of the Eukaryotes
14. Viruses

**practices:**

1 - 2. Tools and equipment used in the microbiological laboratory and the sterilization of them

3 – 4. Different media and cultivation methods

5 – 6. Preparation of plate count agar (PCA) media

7 – 8. Enumeration of total plate count of soil sample with plate count method

9 – 10. Preparation of pure culture with streak plate method

11 – 12. Morphological examination of microorganisms (Gram stain)

13 – 14. Practical exam

**Literature, handbooks**

1. 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
2. Hogg S (2005): Essential Microbiology, John Wiley & Sons Ltd, 481 oldal, ISBN 0 471 49753
3. Talaro, K. P. (2015): Foundations in microbiology, Pasadena City College, Barry Chess, Pasadena City College. – Ninth edition. 929 oldal, ISBN 978–0–07–352260–9

**Mathematics, MTB7005A**

ECTS Credit Points: 4

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

Type of exam: written exam

**Requirements:**

- for signature: Attendance to every lecture and practice is compulsory for the students as the different topics are built upon one another. A catalogue is being made during the lectures for statistical purposes and students should not miss more than five lectures. The semester will be closed by giving each student a grade which will be offered according to the results of the midterm or the final tests. In order to fulfill the subject every student should receive a signature which has a precondition. There should not be more than four uncertified absences from the practices and five uncertified absences from the lectures or 25% should be obtained from the total score of the six midterm tests.

- for a grade: Evaluation will be made according to the results of the midterm (in the 3rd, 5th, 7th, 9th, 11th, 14th week) or the final (in the examination period) tests. Each student gets a recommended grade if the final score from the tests reaches at least 58% of the obtainable total. Every student must receive a signature, too. Those students who were not able to obtain signature or grade during the learning period, will be given 3 extra chances during the exam period.

The current score limits are as follows: Before the examination period Six tests.

 Not compulsory to accept (the students can refuse).

 70-79 points: pass (2).

 80-89 points: satisfactory (3).

 90-99 points: good (4).

 100-120 points: excellent (5).

Examination: In writing.

 0%-49%: fail (1).

 50%-62%: pass (2).

 63%-74%: satisfactory (3).

 75%-86%: good (4).

 87%-100%: excellent (5).

**Summary of content – theory**

The main goal of the subject is that students are introduced to the basic methods and terminology or definitions in mathematics which can be used in our subject. The differential calculus of one-variable function and its practical application is in the center of interest as well as the extreme value and elasticity calculation of one-variable function. During the course of practical lessons students should gain experience in problem solving from the various topics of the subject.

**lectures:**

1. Review of Algebra. Operations. Exponents and Radicals. Algebraic Expressions. Equations. Inequality. Summation Notation.
2. Sets. Set Operations. Sets of Numbers. Cardinality.
3. Functions I. Cartesian Coordinate Systems. Lines. Linear Functions. Applications in Life Sciences.
4. Functions II. Properties of Functions. Quadratic Functions. Polinomial and Rational Functions. Translation and Reflection. Applications in Life Sciences.
5. Functions III. Exponential, Logarithmic and Trigonometric Functions. Applications in Life Sciences.
6. Functions, Limits and Continuity.
7. Differentiation I. Differential Calculus Rules. Higher Order Derivatives.
8. Differentiation II. Curve Sketching.
9. Differentiation III. Optimization, Elasticity and Other Applications.
10. Matrix Algebra I. Matrix Operations.
11. Matrix Algebra II. Gauss-Jordan Elimination.
12. Matrix Algebra III. Eigenvalues and Eigenvectors.
13. Mathematics of Finance. Compound Interest. Present Value. Annuities. Present Value of Annuity. Future Value of Annuity. Amortization of Loans.
14. Summary. Evaluation, Practice for the Examination.

**practices:**

1. Review of Algebra. Operations. Exponents and Radicals. Algebraic Expressions. Equations. Inequality. Summation Notation.
2. Sets. Set Operations. Sets of Numbers. Cardinality.
3. Functions I. Cartesian Coordinate Systems. Lines. Linear Functions. Applications in Life Sciences.
4. Functions II. Properties of Functions. Quadratic Functions. Polinomial and Rational Functions. Translation and Reflection. Applications in Life Sciences.
5. Functions III. Exponential, Logarithmic and Trigonometric Functions. Applications in Life Sciences.
6. Functions, Limits and Continuity.
7. Differentiation I. Differential Calculus Rules. Higher Order Derivatives.
8. Differentiation II. Curve Sketching.
9. Differentiation III. Optimization, Elasticity and Other Applications.
10. Matrix Algebra I. Matrix Operations.
11. Matrix Algebra II. Gauss-Jordan Elimination.
12. Matrix Algebra III. Eigenvalues and Eigenvectors.
13. Mathematics of Finance. Compound Interest. Present Value. Annuities. Present Value of Annuity. Future Value of Annuity. Amortization of Loans.
14. Summary. Evaluation, Practice for the Examination.

**Literature, handbooks**

Greenwell, Raymond N.; Ritchey, Nathan P.; Lial, Margaret: Calculus for the Life Sciences: Global Edition, Pearson Education, 2014, ISBN-13: 9781292062334

E. Haeussler – R. Paul – P. Wood (2014): Introductory Mathematical Analysis for Business, Economics, and the Life and Social Sciences, 13th Edition, PEARSON, UK, ISBN:978-1-29202-114-0

R.J. Harschbarger – J. J. Reynolds (2015): Mathematical application for Management, Life and Social Sciences, Brooks/Cole, USA, Belmont, CA, ISBN: 978-1305108042, 1111 pages

S. T. Tan (2013): Applied Mathematics for Managerial, Life and Social Sciences, Sixth Edition, Brooks/Cole, Belmont, CA, USA, ISBN:1-133-10894-6, Pages 955

K. Sydastaer – P. Hammond (2008): Essential Mathematics for Economic Analysis, Prentice Hall, London, UK, ISBN: 978-0-273-71324-1

**Measurement technics and automatization, MTBE7022A**

ECTS Credit Points: 5

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

Type of exam: Written and oral exam.

**Requirements:**

- for signature: Accepted assignment. Submit Assignment: Development of industrial process control with PLC. The process should have minimum 5 operation steps, with minimum 10 sensors and 10 actuators.

Result: Process document and PLC program.

- for a grade: Written and oral exam.

**lectures:**

1. Introduction of PLC: main internal parts, external modules.
2. Introduction to sensors and actuators: theory of operation.
3. Electrical wiring of PLCs – Source wiring with examples, theory.
4. Electrical wiring of PLCs – Sink with examples, theory.
5. Applied sensor technology: temperature, displacement, pressure. Theory of operation.
6. Applied actuator technology: pumps, valves, fans, mixers. Theory of operation.
7. Introduction to digital logic: basic logic gates. Theory.
8. PLC programming basics: implementation of basic logic.
9. PLC programming: timers: TON, TOF with examples.
10. PLC programming: counters and examples.
11. Introduction to PLC program development environment.
12. PLC program development: process design methods.
13. PLC program development: programming methods.
14. PLC program development: program verification methods.

**practices:**

1. Introduction of PLC: application examples.
2. Introduction to sensors and actuators: application examples.
3. Electrical wiring of PLCs – Source with examples, calculations.
4. Electrical wiring of PLCs – Sink with examples, calculations.
5. Applied sensor technology: temperature, displacement, pressure. Practical examples.
6. Applied actuator technology: pumps, valves, fans, mixers. Practical examples.
7. Introduction to digital logic: basic logic gates. Examples.
8. PLC programming basics: implementation of basic logic. Application exam
9. ples.
10. PLC programming: timers: TON, TOF with examples. Application programming.
11. PLC programming: counters and examples. Application programming.
12. Introduction to PLC program development environment. Application programming.
13. PLC program development: process design examples.
14. PLC program development: programming examples.
15. PLC program development: program verification examples.

**Literature, handbooks**

J. G. Webster “The Measurement, Instrumentation and Sensors handbook”, IEEE PRESS, 1999

Mitsubishi Electric, Structured Text (ST) Programming Guide Book, ST-GUID-E, http://dl.mitsubishielectric.com/dl/fa/document/manual/plc/sh080368e/sh080368eh.pdf

J. Karl-Heinz ed. “IEC 61131-3: Programming Industrial Automation Systems”, Springer, ISBN 978-3-642-12015-2

**Modern bioanalytical methods, MTBE7018A**

ECTS Credit Points: 3

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

Type of exam: **written** (if only the subject is signed)

**Requirements:**

- for signature:

Participation at practice is compulsory. Students must attend the practice classes and may not miss more than three times during the semester. In case a student does so, the subject will not be signed and the student must repeat the course. Being late is counted as an absence. In case of further absences, a medical certificate needs to be presented. Missed practices should be made up for at a later date, being discussed with the tutor.

- for a grade: During the semester student has to write 2 theoretical and 1 practical tests. The minimum requirement for every mid-term and end-term tests is 50%. Based on the score of the tests separately, the grade for the tests is given according to the following table:

Score (%) Grade

0-49 fail (1)

50-65 pass (2)

66-74 satisfactory (3)

75-89 good (4)

90-100 excellent (5)

The student has to reach minimum 50% in every test. The student twice can take a retake test of the whole semester material.

**Summary of content – theory**

Course objectives: description of instruments and methods used in modern bioanalysis.

**lectures:**

1. Techniques for Identifying Low-Food Compounds(UV-VIS, IR)
2. Determining Vitamins
3. Antioxidants and their Determination
4. Separation Technique (GC, HPLC)
5. Determine the sugars
6. Determination of fats and fatty acids
7. Mass Spectrometry (FAB / FIB, MALDI, API, MS)
8. Connected Analysis Methods (LC-MS, GC-MS, MS-MS)
9. Micro Extraction Techniques (SPME, LPME)
10. Definition of Proteins
11. Determination of Organic Micro-Contaminants
12. DNA, RNA
13. DNA, RNA
14. DNA, RNA

**Summary of content - practice**:

Skills to be learnt: the use of instruments and methods used in modern bioanalysis in practice

**practices:**

1. Introduction of UV-VIS
2. Measurement with FRAP method
3. Measurement with DPPH method
4. Introduction of HPLC
5. Measurement of standards with HPLC
6. Measurement of sapmes with HPLC
7. Introduction of Mass Spectrometer
8. First practice test
9. Introduction of Micro Extraction Techniques (SPME, LPME)
10. Introduction of Proteins measurement methods
11. DNA, RNA
12. DNA, RNA
13. Second practice test

**Literature, handbooks**

Dr. Istvan Bak: Modern analytical techniques in the pharmaceutical- and bioanalysis (2011)

**Molecular and cell biology, MTBE7001A**

**Name and title of the person responsible for the subject:** Dr. Endre Máthé, associate professor PhD

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

**Name and level of the program:** Food engineering BSc

**Subject type:** compulsory;

**Teaching timetable of the subject, type of examination:** 2 lect. + 2 pract., oral

**Credit value of the subject: 4**

**Purpose of teaching the subject:**

System biology type of interpretation of the molecular and cellular organization levels of living matter and life phenomena. Structural and functional features of pro- and eukaryotic cells. Genome structure and expression of genetic information. The cell cycle and its regulation. Presentation of molecular relationships related to cell structure and function and the most important molecular research methods.

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

**LECTURES**:

Course objectives:

1-3. Analysis of cellular and molecular levels of organization of living material, and combined cellular and molecular investigation methods.

4-5. Eukaryotic compartments, cellular organelles and homeostasis.

6-8. Cell nucleus, nucleolus, chromosomes. Gene expression. DNA replication and repair. Nuclear transport.

9-10. Cytoskeleton: actin, intermediate filaments, microtubules, centrosomes, mitotic spindle.

11-12. Mitochondria. Regulation of cellular metabolism: glycolysis, Krebs cycle, ETC, beta-oxidation, ATP synthesis.

13-14. Spatial and temporal regulation of cellular events, the cell cycle.

**PRACTICALS**:

1-2. Microscopic analysis of chromosomes.

3-5. Molecular investigation methods. Genomic and plasmid DNA isolation. PCR techniques.

6-8. Molecular cloning and analysis of transgenic organisms.

9-11. Immunofluorescence analysis of eukaryotic cell related structures.

12-14. *In silico* genome-, proteome- and interactome analysis.

**Type of mid-term examination:** participation in the practicals is mandatory. Attendance at 70% of the practicals is mandatory. In case of absence, a report must be submitted by the student within two weeks from the missed practice (theoretical and practical description).

Participation in the practicals is a precondition for the final exam.

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

**Teaching aids:** lecture specific PPTs, research/review papers

**Recommended literature:**

• Alberts, B., Brey, D., Hopkin, K., Johnson, A., Lewis, J., Raff, M., Roberts, K., Walter, P. (2016). Essential cell biology. 4th edition. Garland Science, Taylor & Francis Group, New York, USA. ISBN-13: 978-0815344544

• Alberts, B., Johnson, A, Lewis, J. Morgan, D., Raff, M., Roberts, K., Walter, P. (2014). Molecular Biology of the Cell. Sixth Edition. Garland Science, Taylor & Francis Group, New York. ISBN-13: 978-0815344322

• Pollard, T.D., Earnshaw, W.C., Lippincott-Schwartz, J. and Johnson, G. (2017). Cell Biology, 3rd Edition, Elsevier, ISBN: 9780323341264

• PUBMED database

**Nutrition Knowledge, MTBE7038A**

ECTS Credit Points: 3

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

Type of exam: colloquium

**Requirements:**

- for signature: Attendance at lectures is not compulsory, but highly recommended!

As an individual activity, all of the students have to complete and present to the other students two power point presentations. The theme of it will be jointly decided by the student and the lecturer. Form and content of presentations will be discussed by the group members, and will be accepted or denied. The denied presentation must be repeated. Requirement to get signature is, two accepted .ppt-presentations.

- for a grade: Oral (preferred) and/or written

**Summary of content – theory**

The subject is some basic knowledge area, how the human body will take up the components of the food. The recommended daily intake levels of food components will be discussed. The efficiency of kitchen technology on the nutrient content and on the digestibility of foods will also be discussed. Students will get a general overview and examples, what “functional food” means. The aim of the subject is to provide the students knowledge how the most suitable food raw materials and kitchen techniques can be chosen by preparing foods.

**lectures:**

1st week: The definition of nutrition. Basic kitchen operations and tools. Chemical composition of food raw materials

2nd week: Energy content of foods, energy needs of the human organisms. Some important recommendations

3rd week: Amino acids and proteins in foods from different origin. Quantity needs and quality issues

4th week: Carbohydrates: structure and role of mono-, di- and oligosaccharides; functions of polysaccharides of plants and animals/human beings

5th week: Carbohydrates and dietary fibers. Recommendations for quantity and quality. Sugar replacers (sweeteners), their advantages and disadvantages and to-solve-problems.

6th week: Lipoids and lipids. Essential and conditionally essential fatty acids, omega-3 fatty acids. Their recommended intake amounts and sources

7th week: Structure of protein building amino acids. Definition of non-essential, essential and conditionally essential amino acids. Amid and peptide bonds. Protein structures and shapes. Protein complementation, protein quality

7th week: Water soluble vitamins – their structure, chemical composition, physiological role, symptoms of hypo- and avitaminosis. RDA values

8th week: Fat soluble vitamins (The “DEKA” vitamins) – their structure, chemical composition, physiological role, symptoms of hypo- and avitaminosis, reason and symptoms of hypervitaminosis. Night blindness, rickets. Natural sources of A-, D-, E- and K-vitamins

9th week: Energy metabolism. Synthesis of ATP molecules: Reactions and energetic results of citric acid cycle (Szent-Györgyi - Krebs cycle) and the sequential oxidative phosphorylation processes

10th week: Energy balances and body weight regulation. Basal metabolic rate (BMR), basal energy expenditure (BEE), resting metabolic rate (RMR), resting energy expenditure (REE), standard metabolic rate (SMR)

11th week: Structure and functions of gastro-internal hormones

12th week: Cholesterols and their problems.

13th week: Lactose intolerance: reason and symptoms. Geographical differences of lactose intolerance. Possible solutions

14th week: Vegan diet. Anaemia, iron deficiency and symptoms. Effect of “fashion diets” on the human body.

**Literature, handbooks**

Tarabella, Angela – Burchi, Barbara (2016): Aware Food Choices: Bridging the Gap Between Consumer Knowledge About Nutritional Requirements and Nutritional Information. Springer Verlag, Berlin, Heidelberg. ISBN-13: 978-3-319-23856-2

**Oil and fat technology, MTBE7033A**

ECTS Credit Points: 3

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

Type of exam: written exam

**Requirements:**

- for signature: Participating in the exercises.

- for a grade: written exam

**Summary of content – theory**

Course objectives: to provide practical up-to-date information on oil and fat processing including chemical structure, conventional and special raw materials, typical sources for the industry, processing techniques and technologies and economics and market aspects, tendencies. The course provides information to improve the knowledge and the practical skills of the students.

**lectures:**

1. Exercise 1 - Raw materials of oil industry (plants, cereals, vegetables, fruits), properties of the oil (Chemical parameters)
2. Exercise 2 - Technology of oil production, oil refining
3. Exercise 3 - Oil groups, by-products of oil production
4. Exercise 4 - Quality and (physical and chemical) properties of oil
5. Exercise 5 - Special oil plants – pressed from different parts of plant (seed, pulp, flower, sprout, root, steam, leaf
6. Exercise 6 - Essential oils, aroma oils, oily extracts, squalene, other oils
7. Exercise 7 - Animal oils, plants/cereals//vegetables/fruits fat
8. Exercise 8 - Structure and classification of fat lipids
9. Exercise 9 - Animal fat as raw material and food ingredient
10. Exercise 10 - Fat processing technology
11. Exercise 11 - Fat types and by-products
12. Exercise 12 - Quality and properties of fat and oil
13. Exercise 13 - Special oils and fats
14. Exercise 14 - The oil and fat market (2018)

**practices:**

1. Practice block 1 – Oil processing technology (oil pressing)
2. Practice block 2 – Labor practice (qualification of oils)
3. Practice block 3 – Fat processing technology
4. Practice block 4 - Labour practice (qualification of fats)

**Literature, handbooks**

Diósi G., Sttündl L. (2019): Practical exercises for the course of Oil and fat technology. – Textbook. University of Debrecen, Faculty of Agricultural and Food Sciences, and Environmental Management

Talati, A: Extraction Methods Of Natural Essential Oils. Method. February 2017. DOI: 10.13140/RG.2.2.18744.34564

Anon: Production Of Lipids From Natural Sources. http://ocw.nagoya-u.jp/files/1/chap2.pdf

**Organic chemistry, MTBE7002A**

ECTS Credit Points: 3

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

Type of exam: written or oral exam

**Requirements:**

- for signature: To fulfill the 35% of the tests (get signature for the practise) If the student fulfils the tests with a result of more than 50%, a grade is offered, which can be improved in a written exam.

- for a grade: The results of the tests + homework are summarized and give the final grade. If students fail to do it they have to take a written exam.

**Summary of content – theory**

This course gives basic knowledge for the subsequent biochemistry and food chemistry subjects.

**lectures:**

Week 1: C-hybrid states. Classification of organic compounds by carbon skeleton and functional groups. Bond line drawing.

Week 2: Intermolecular forces, polarity, physical properties of organic molecules

Week 3: Hydrocarbons. Major types of organic chemical reactions (substitution, addition, polymerization). Dienes, polyenes (terpenes). The chemical properties of terpens.
Week 4: Benzene, aromatic compounds,

Week 5: Alcohols.. ethers, tiols,

Week 6: Aldehydes , ketones

Week 7: Carboxylic acids and their derivatives

Week 8: Carbohydrates, monosaccharides,

Week 9: Carbohydrates, disaccharides, oligosaccharides and polysaccharides

Week 10. Amino acids, peptides and proteins
Week 11: Lipids I , hydrolisable lipids

Week 12: LipidsII. Non hydrolisable lipids

Week 13: Pyridine and pyrimidine and their derivatives. Purine and its derivatives. Lactim-lactam tautomerism. Structure of nucleosides and nucleotides

Week 14: Primary structure, secondary structure of nucleic acids. Relationship between the structure and biological function of nucleic acids.

**Summary of content – practice**

In almost every lesson students write a test, that gives feedback about their knowledge.

Drawing Lewis structural formula and bond line formula, recognizing the different types of isomers.

**practices:**

1. Test + Exercises related to the intermolecular forces and physical properties
2. Test + Exercises related to hybridization and nomenclature and chemical reactions of hydrocarbons
3. Test + Exercises related to, aromatic compounds, alcohols, ethers, aldehydes, ketones, carboxylic acid.
4. Test + Exercises related to carbohydrates
5. Test + Exercises related to amino acids, proteins and lipids
6. Test + Exercises related to nucleic acids, review questions
7. Final test

**Literature, handbooks**

Frederick A. Bettelheim, Mary K. Campbell, Shawn O. Farrell, William H. Brow

Introduction to General, Organic and Biochemistry ISBN-13-9780495110699

[T. W. Graham Solomons](https://www.amazon.com/T.-W.-Graham-Solomons/e/B001H6O6KQ/ref%3Ddp_byline_cont_book_1), [Craig B. Fryhle](https://www.amazon.com/s/ref%3Ddp_byline_sr_book_2?ie=UTF8&text=Craig+B.+Fryhle&search-alias=books&field-author=Craig+B.+Fryhle&sort=relevancerank) [Scott A. Snyder](https://www.amazon.com/s/ref%3Ddp_byline_sr_book_3?ie=UTF8&text=Scott+A.+Snyder&search-alias=books&field-author=Scott+A.+Snyder&sort=relevancerank) Organic chemistry ISBN-13: 978-1118133576

David R, Klein Organic chemistry as a second language 2004, John Wiley and Sons Inc, ISBN 0-471-27235-3

**Packaging technology MTBE7039**

ECTS Credit Points: 3

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

Type of exam: written exam

**Requirements:**

- for signature: Giving presentation (10 minutes).

- for a grade: written exam

**Summary of content – theory**

The types of packaging materials (textiles, wood, metal, glass, paper and plastic), pairing possibilities. The quality of packaging and reliability. Packaging machines and devices, environmental impact of packaging materials, re-processability. Food and packaging interaction (diffusion and migration). The food commodity marking (labelling). Mandatory and voluntary labelling (use of information and advertising).

**lectures:**

1. Packing elements (basic concepts, aims and tasks of the pack)
2. Functions of the packaging, Basic information on the labelling of packaging
3. Packaging Training (consumer and multipack packaging)
4. Packaging design, marketing
5. Paper packaging
6. Metal packaging
7. Plastic packaging I.
8. Plastic packaging II. Migration from plastic packaging into food
9. Plastic packaging III.
10. Glass containers (narrow and wide-mouth jars and closing their methods)
11. Wood packing materials
12. Textiles packing materials
13. Combined packaging supplies
14. Packaging machinery

**practices:**

1. Packing elements (basic concepts, aims and tasks of the pack)
2. Functions of packaging, Basic information on the labelling of packaging
3. Packaging Training (consumer and multipack packaging)
4. Packaging design, marketing
5. Paper packaging
6. Metal packaging
7. Plastic packaging I.
8. Plastic packaging II. Migration from plastic packaging into food
9. Plastic packaging III. Calculations
10. Glass containers (narrow and wide-mouth jars and closing their methods)
11. Wood packing materials
12. Textiles packing materials
13. Combined packaging supplies
14. Packaging machinery

**Literature, handbooks**

Richard Coles, Derek McDowell, Mark J. Kirwan: 2003. Food packaging technology. CRC Press, London. 346 p. ISBN 9780849397882.

Dong Sun Lee, Kit L. Yam, Luciano Piergiovanni: 2008. Food Packaging Science and Technology. CRC Press, London. 656 p. ISBN 9780824727796.

Gordon L Robertson: 2013. Food Packaging Principles and Practice. CRC Press, London. 686 p. ISBN 9781439862421.

**Physical chemistry MTBE7008A**

ECTS Credit Points: 4

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

Type of exam: written exam

**Requirements:**

- for signature: Attendance at **lectures** is recommended, but not compulsory.

Participation at **practice** is compulsory. Students must attend the practice classes and may not miss more than three times during the semester. In case a student does so, the subject will not be signed and the student must repeat the course. Attendance at practice classes will be recorded by the practice leader.

- for a grade: Completing assignments, giving presentation, Take an exam. The minimum requirement for the test is 60%.

0-59 % fail (1)

60-69 % pass (2)

70-79 % satisfactory (3)

80-89 % good (4)

90-100 % excellent (5)

 **lectures:**

1. Basic concepts of the chemical thermodynamics: System, wall and features. Extensive and intensive properties. Temperature, internal energy.
2. Main laws of thermodynamics. Work, volume work cycle.
3. Enthalpy. Material and energy balances. Entropy and its calculation. Thermodynamic potential functions. The thermodynamic system of relationships. Euler and Gibbs-Duhem equation. Equilibrium conditions for extensive and intensive parameters.
4. One-component systems: gases. Ideal gas state.
5. Isothermal and adiabatic process. Poisson equation. Real gas equation of state. Van der Waals equation. Liquids.
6. Gibbs phase rule. Clausius-Clapeyron equation. Phase diagram of water. Multi-component systems.
7. Mixtures. Partial molar quantities. Ideal mixtures. Dalton's Law. The chemical potential. Realistic mixtures, activity.
8. Binary mixtures of vapor-liquid equilibrium. Raoult's Law. Azeotropic mixtures. The Basics of distillation.
9. Colligitave traits. Dilute solutions, vapor pressure and boiling point increase decrease. Freezing point depression. Osmotic pressure and its biological significance. Gas dissolution fluid. Henry's law. Mutual solubility of liquids. Limited immiscible liquids. Immiscible liquids.
10. Steam distillation. Partition coefficient. Dissolution of solids and liquid, the solubility is a function of temperature. Mutual solubility of solids.
11. Chemical equilibrium. The equilibrium constant and the standard free energy change of reaction. Van't Hoff equation, exothermic and endothermic reactions. The equilibrium constant changes in pressure, Le Chatelier-Braun principle.
12. Reaction kinetics, basic concepts of reaction rate, half-life. Simple reaction rate equations. Complex reactions. Consecutive and parallel reactions. Chain Reaction. Arrhenius equation. Homogeneous and heterogeneous catalysis. Enzyme catalysis.
13. Basic concepts of electrochemistry. Electrolytic dissociation, conductivity, Kohlrausch rule. Ostwald's dilution law. Solubility. Galvanic and electrode potentials. Electrodes. Redox potentials. Concentration elements. The forms of corrosion. Corrosion current and potential. Corrosion protection
14. Heat transport

**practices:**

Calculations in physical chemistry:

1. Exercise 1. Concentration units and their conversion
2. Exercise 2. Density calculation
3. Exercise 3. Ideal gas related calculations
4. Exercise 4. Calculation of volumetric work
5. Exercise 5. Calculation of energy in heating and cooling
6. Exercise 6. Energy conversion of phase transition
7. Exercise 7. Chemical reactions energy calculation
8. Exercise 8. Calculations related to Clausius-Clapeiron equation
9. Exercise 9. Dilute solutions laws
10. Exercise 10. Equbrillium calculations
11. Exercise 11. Calculations of reaction rate
12. Exercise 12. Electrochemical equibrillium calculations
13. Exercise 13. Heat transfer calculations
14. Exercise 14. practical problems solution with calculations

**Literature, handbooks**

Atkins, P.W.: Fizikai Kémia I-III. Budapest, 1998.

Atkins, P.W.: Fizikai Kémia I-III. A tankönyvi feladatok megoldásai. Budapest, 1998.

Atkins,W.,P.: Physical Chemistry, Oxford University Press, 1990.

Chang, R.: Physical Chemistry with Applications to Biological Systems, Macmillan Publishing Co. New York, 1977.

**Plant Physiology, MTB7014A**

ECTS Credit Points: 3

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

Type of exam: signature for practice + exam

**Requirements:**

- for signature: Completing assLab Reports, participating in all of the practices.

- for a grade: oral or written exams

**Summary of content – theory**

The study of plants as producers is really important because of their position at the energy and elemental intake portion of the energy pyramid and the food net. The lecture with practice is designed to provide comprehensive exposure to the subject of plant physiology. Students learn about the functions of plants throughout their development from seeds through reproduction. Lectures and laboratory practices are covered from the biochemical level to the organism level. Laboratory exercises complement lectures.

**lectures:**

|  |
| --- |
| 1. Basics in plant physiology, structure and function
 |
| 1. Leaves, light absorption in photosynthesis
 |
| 1. Carbon acquisition and fixation
 |
| 1. Respiration (photo-, and dark)
 |
| 1. Plant water relations: stomata, transpiration and plants in water-limited environments
 |
| 1. Functions of nutrients in plant I.
 |
| 1. Functions of nutrients in plant II.
 |
| 1. Symbiotic relationships for nutrient capture, Nitrogen assimilation
 |
| 1. Plant hormones – regulation of development and Plant hormones – environmental acclimation I.
 |
| 1. Plant hormones – regulation of development and Plant hormones – environmental acclimation II.
 |
| 1. Flowering
 |
| 1. Fruit and seeds
 |
| 1. Seed germination/dormancy
 |
| 1. Senescence
 |

**practices:**

|  |
| --- |
| 1. Investigation of basic characteristics of enzyme
 |
| 1. Photosynthetic pigments
 |
| 1. CO2 fixation
 |
| 1. Intensity of respiration
 |
| 1. Plant water relations
 |
| 1. Mineral nutrition and plant growth
 |
| 1. Mineral nutrition and plant growth
 |
| 1. Mineral nutrition and plant growth
 |
| 1. Plant hormones
 |
| 1. Plant hormones
 |
| 1. Plant hormones
 |
| 1. Plant storage products
 |
| 1. Germination and shooting
 |
| 1. *In vivo* physiological measurements
 |

**Literature, handbooks**

Kovács B – Csapó J.: Modern methods of food analysis. University of Debrecen, Faculty of Agricultural and Food Science and Environmental Managemenet. 2015. 1-205.

Nollett, L.M.L. – Toldra, F.: Food analysis by HPLC. CRC Press. Taylor & Francis Group. Boca Raton. 2013. 1-1033.

Anderson, J.L. – Berthod, A. – Pino Estevez, V. – Stalcup, A.M.: Analytical Separation sciences. Wiley-VCH Verlag GmbH &Co. KGaA. 2015. 1-1929.

Mondello. L. (Ed.): Comprehensive chromatography in combination with mass spectrometry. John Wiley & sons. Inc. 2011. 1-491.

Cruz, R.M.S. – Khmelinskii, I – Vieira, M.C.: Methods in food analysis. CRC Press, Taylor & Francis Group. Boca Raton. 2014. 1-250.

**Processing and preservation of horticultural products, MTBE7028A**

ECTS Credit Points: 3

28 hour(s) lecture and weekly practice per semester

Type of exam: Written and oral exam

**Requirements:**

- for signature: -

- for a grade: Written and oral exam

**Summary of content - lecture**:

The course aims to introduce students the quality, rating, storage and processing of fruits and vegetables, the properties and requirements of main product groups and the factors influencing their quality.

**lectures:**

1. Quality of fruits and vegetables; chemical and physical parameters.
2. Maturation, physiology of maturation, methods determining the maturity stage.
3. Storage, storing methods, processes during storage.
4. Deterioration processes of horticultural products.
5. General operations and preparation methods of fruit and vegetable processing.
6. Preservation by heat extraction, process of freezing, freezing methods, frozen products.
7. Preservation by water extraction, process of drying, drying methods, dried products.
8. Concentrated products, thermal and non-thermal processes.
9. Preservation by heat treatment, heat-treating methods, heat-treated products.
10. Fermentation processes: lactic acid fermentation, methods and products.
11. Fermentation processes: alcoholic and acetic acid fermentation, methods and products.
12. Wine production.
13. Preservation by irradiation and chemical preservation.
14. Combined preservation and novel methods in preservation.

**Literature:**

James G. Brennan (ed.) 2006. Food Processing Handbook. WILEY-VCH Verlag GmbH & Co. KGaA, Weinheim, ISBN: 3-527-30719-2. p. 582.

M. Shafiur Rahman (ed.). 2007. Handbook of food preservation, Taylor and Francis Press. p. 1068.

Zeki Berk (ed. Steve L. Taylor) 2009. Food Process Engineering and Technology. Elsevier. p. 605.

P. Fellows 2000. Food Processing Technology. Published by Woodhead Publishing Limited. Abington Hall, Abington, Cambridge CB1 6AH, England. (ISBN 1 85573 533 4) p. 575.

Y. H. Hui, S. Ghazala, D. M. Graham, K.D. Murrell,W Nip 2004: Handbook of Vegetable Preservation and Processing. Maecel Dekker Inc., 752. p.

Y. H. Hui, J. Barta, M. P. Cano, T.W. Gusek, J. S. Sidhu, N. K. Sinha 2006: Handbook of Fruits and Fruit Processing. Wiley-Blackwell, 712. p.

D. M. Barrett, L. Somogyi, H. S. Ramaswamy 2004: Processing Fruits: Science and Technology. CRC Press, 864. p.

**Processing Technologies of Agricultural Crops, MTBE7021A**

ECTS Credit Points: 4

28 hour(s) lecture and weekly practice per semester

Type of exam: written exam

**Requirements:**

- for signature: -

- for a grade: written exam

**lectures:**

1. Food safety, Food quality, Food processing, Food economic
2. Food, non-food, new-food

# Quality of cereals (wheat, rye, triticale, oats, barley, corn/maize, rice, sorghum, millet)

1. Storage of cereals, mill technology
2. Quality and quantity parameters of wheat flour
3. Baking technology (bread, pasta), flour
4. Corn/maize processing
5. Starch technology
6. Quality and quantitative parameters of potato, potato processing and products
7. Oil technology, quality and quantitative parameters of oils
8. Sugarbeet processing, sugar technology
9. Confection industry (candy, chocolate)
10. Production of malt, beer production
11. Fermentation industries: alcohol, fuel (bioethanol), yeast production

**practices:** Weekly practice

**Literature, handbooks:** handbooks in English

**Professional language skills I. (English) MTB7NY1A**

ECTS Credit Points: 3

0 hour(s) lecture and 56 hour(s) seminar per semester

Type of exam: practical course mark

**Requirements:**

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

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

**Summary of content - practice**:

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

**practices:**

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

1. Academic vs everyday English
2. Key nouns, verbs
3. Key adjectives, adverbs
4. Phrasal verbs in academic English. Key quantifying expressions.
5. Words with several meanings. Metaphors and idioms.
6. Nouns and the words they combine with. Adjective and noun combinations. Fixed expressions.
7. Verbs and the words they combine with. Prepositional phrases. Verbs and prepositions. Nouns and prepositions.
8. Midterm exam
9. Sources. Facts, evidence and data. Graphs and diagrams.
10. Reporting what other say. Analysis of results.
11. Research and study aims. Talking about points of view. Organising your writing.
12. Describing problems. Evaluation and emphasis. Summary and conclusion.
13. Revision
14. End term, Evaluation

**Literature**

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

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

Michael McCarthy, Felicity O’Dell: Academic Vocabulary in Use

**Professional Language Skills II. (English) MTB7NY2A**

ECTS Credit Points: 3

0 hour(s) lecture and 54 hour(s) seminar per semester (0+4/week)

Type of exam: practical

**Requirements:**

- for signature: 3 allowed absences per semester. Active participation in group discussion.

- for a grade: Completing assignments / exercises. Continuous tests orally and written.

**Summary of content - theory**:

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

**practices:**

 1. Revision of previous semester’s vocabulary
2. Practice
3. Making presentations
4. Presentations
5. Describing research methods, Classifying
6. Making connections, Comparing and contrasting
7. Describing problems, Evaluation and emphasis
8. Midterm exam
9. Complex cases studies – speaking and writing
10. Complex cases studies - speaking and writing
11. Complex cases studies - speaking and writing
12. Revision
13. End term
14. Evaluation

**Literature**

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

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

Michael McCarthy, Felicity O’Dell: Academic Vocabulary in Use

**Quality control of animal origin food products MTBE7037A**

ECTS Credit Points: 3

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

Type of exam: Oral exam

**Requirements:**

- for signature: Completing assignments / exercises and submitting essay.

- for a grade: Oral exam.

**Summary of content - theory**:

During the course students learn about the manufacturing problems of dairy products and their qualification possibilities. Basic rules for meat certification are presented. We analyze the more common quality defects in meat products. The students who have attended the course can learn the possibilities of eliminating the errors and the critical points during the qualification.

**lectures:**

1. Quality requirements of milk composition (dry matter, fat, carbohydrate, protein, mineral, vitamin, enzyme, etc.)
2. Change in the microbial content of the milk, the most important micro-organisms in the milk
3. Certification system for raw milk, and production of low-fat milk,
4. Quality defects and qualification of yoghurt and kefir during and after the processing
5. Technological solutions of cottage cheese making, critical points in production, qualification.
6. Cheeses manufacturing processes, critical points in production, certification
7. Butter production processes, critical points in production, certification
8. Historical review of meat inspection of domestic animal. Types of slaughterhouses, small and large-scale slaughter.
9. Rules, conditions of meat inspection, examination of meat of different species.
10. Cooling, freezing and storage of products.
11. Postmortal changes in muscle and fat tissue.
12. Technology of poultry processing, quality requirements.
13. Production of dry goods, sampling and inspection procedures.
14. Production of marinated goods, sampling and control procedures….

**Literature, handbooks**

Meat Science: An Introductory Text 2 nd edition ISBN 9780851994246

Muscle Development of Livestock Animals: Physiology, Genetics and Meat Quality, [Marinus Te Pas](https://www.amazon.co.uk/s/ref%3Ddp_byline_sr_book_1?ie=UTF8&text=Marinus+Te+Pas&search-alias=books-uk&field-author=Marinus+Te+Pas&sort=relevancerank) [Henk Haagsman](https://www.amazon.co.uk/s/ref%3Ddp_byline_sr_book_2?ie=UTF8&text=Henk+Haagsman&search-alias=books-uk&field-author=Henk+Haagsman&sort=relevancerank) [Maria Everts](https://www.amazon.co.uk/s/ref%3Ddp_byline_sr_book_3?ie=UTF8&text=Maria+Everts&search-alias=books-uk&field-author=Maria+Everts&sort=relevancerank), CABI Publishing, , ISBN-10: 9780851998114

Dairy Science and Technology : P. Walstra;Pieter Walstra;Jan T. M. Wouters;Tom J. Geurts, CRC Press, ISBN 08247-2763-0

Meat products handbook Practical science and technology, G. Feiner, **eBook ISBN:** 9781845691721, Woodhead Publishing, 2006.

**Quality control of plant origin food products, MTBE7036A**

ECTS Credit Points: 3

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

Type of exam: written exam

**Requirements:**

- for signature: Attendance at **lectures** is recommended, but not compulsory.

Participation at **practice** is compulsory. Students must attend the practice classes and may not miss more than three times during the semester. In case a student does so, the subject will not be signed and the student must repeat the course. Attendance at practice classes will be recorded by the practice leader. Completing assignments and giving presentation

- for a grade: The minimum requirement for the test is 60%.

0-59 % fail (1) /60-69 % pass (2)/ 70-79 % satisfactory (3) / 80-89 % good (4) / 90-100 % excellent (5)

**Summary of content - theory**:

This subject purposes to improve the student’s competence to understand the importance of different quality parameters in agricultural or food use and to prepare them for the interpretation of processes 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.

**lectures:**

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 control 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)

**Summary of content - practice**:

The general aim of the practice is to enable students to acquire knowledge of the processing raw material and finished product qualification. We will carry out specific quality tests for products of plant origin for different manufacturing uses. Absence from practice in the given semester is possible but only 3 occasions.

**practices:**

1. Safety education and accident prevention
2. Demonstration the tools using in the practice
3. Quality requirements of different plant origin food products. Using standards in the practice
4. Sampling tools
5. Purity evaluation
6. Calculation practice
7. Determination the starch content
8. Measure the hectoliter mass
9. Determination the wet gluten content
10. Measure the gluten spreading
11. Calculation practice
12. Measure the potato dry matter content
13. Potato quality control (reducing sugar content)
14. Potato quality control (fry colour)

**Literature, handbooks**

Kent K. Stewart-John R. Whitaker (1984): Modern Methods of Food Analysis. Avi Publishing Company, INC Westport, Connecticut. ISBN: 978-94-011-7381-0

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

Sipos, P. (2013): Quality analysis of Agricultural Products. University of Debrecen. ISBN:978-963-473-660-8

**Raw materials of food processing, MTBE7015A**

ECTS Credit Points: 3

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

Type of exam: written exam

**Requirements:**

- for signature: -

- for a grade: written exam

**lectures:**

1. Exercise 1 – Food chain, sustainability, quality
2. Exercise 2 - Cereals I. (winter wheat, triticale, rye, barley, oats)
3. Exercise 3 - Cereals II. (maize, rice, pseudocereals)
4. Exercise 4 - Oil crops (sunflower, rape), sugar crops (sugar-beet, sugar-cane)
5. Exercise 5 - Vegetables (cucurbits, Solanaceae, pulses, Brassica vegetables, root vegetables, leaf vegetables, bulb vegetables, asparagus types)
6. Exercise 6 - Fruits (pome fruits, berried, hard-shell, shell fruits, exotic and tropic fruits)
7. Exercise 7 - Herbs, spices, Caffeine (Tea, Coffee), Spirits (brandy), Soft drink
8. Exercise 8 - Measure properties of farm animals
9. Exercise 9 - Pig/Pork
10. Exercise 10 - Sheep/lamb and goat
11. Exercise 11 - Cow/Beef (meat and milk)
12. Exercise 12 - Poultry/chicken (egg, meat)
13. Exercise 13 – Other poultry (turkey, guinea fowls, goose, duck, pigeons, ratites – ostrich and emu)
14. Exercise 14 – Other animals (rabbit, fish, bee, game – hunted animals)

**practices:** Weekly practice

**Literature, handbooks**

1. Practical exercises for the coure of raw material – Dr. Gerda Diósi , University of Debrecen, Faculty of Agricultural and Food Sciences, and Environmental Management

**Regulation and administration of agriculture MTB7029A**

ECTS Credit Points: 3

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

Type of exam: written exam

**Requirements:**

- for signature: Attendance at lectures is recommended, but not compulsory. Completing assignments, exercises, submitting essay, giving presentation.

- for a grade: Completing a test.

**Summary of content - theory**:

In this course, students will get some basic legal knowledge and an overview of the legal system of the EU and Hungary. The course will give students basic information about the institutions and the history of EU. They will get an overview of the past and present the legal regulations on food law and agricultural law. The students will be able to understand and use the special legal term of food law. The students will gain an overview of the legal concepts relevant to the control and administration of the food industry. The students will be able to understand the purposes and background of food law, both domestic and EU.

**lectures:**

1. Prelude, basic concepts of law, hierarchy of the Hungarian legal system, legislators.
2. Fundamentals of Civil Law and Civil Procedure Law, the legal action, the Hungarian judicial system, orders, the lawsuit process.
3. The European Union I. – a historical and institutional overview
4. The European Union II. - The legal system of the European Union, the primacy of European Union law
5. The general principles and requirements of EU food law - Regulation (EC) No 178/2002 of the European Parliament and of the Council of 28 January 2002 laying down, establishing the European Food Safety Authority and laying down procedures in matters of food safety, The European Food Safety Authority (EFSA), RASFF - Food and Feed Safety Alerts
6. The history of legal regulation on food production
7. The Hungarian national legal regulation on food safety. The Act XLVI. of 2008 on the Food Chain, Codex Alimentarius Hungaricus
8. The European consumer law and its importance
9. Fundamental of substantive law; property, protection of property, asset, immovable estate, original and derivative feature of ways of acquisition, overbuilt, use.
10. Legal capacity
11. Fundamentals of contract law I.
12. Fundamentals of contract law II.
13. The Structure of Hungarian Soil Use, regulation, delimination of acquisition of soil, special Rules of Acquisition, in the sylviculture, water management, regulation of Soil Use, contracts of soil use.
14. Agricultural Register, history, development, operative rules.**practices:** Weekly practice

**Literature, handbooks**

Joseph A. McMahon: EU Agricultural Law and policy, Edward Elgar Pub, 2019. ISBN-13: 978-1781002544

Bernd van der Meulen: EU Food Law Handbook, Wageningen Academic Publishers Books, 2012. ISBN 978-90-8686-246-7

Jens Hartig Danielsen: EU Agricultural Law, Wolters Kluwer, Holland, 2013. ISBN: 9789041132802

**Statistics,** **MTB7028A**

ECTS Credit Points: 3

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

Type of exam: practical

**Requirements:**

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

- for a grade: practical exam.

**Summary of content - theory**

The students will get acquainted with the most modern measurement, data-logging, data processing and analytical methods. They attain the skills of analysing environmental data and huge databases on their own, as well as drawing technically proper consequences from these.

**lectures:**

1. The aim and role of Statistics, basic concepts. Probability, independence, criterion, population, sample. Random sampling, systematic error, parameter.
2. Organizing data into a database, database management systems, characteristics of data, levels of measurement.
3. Determining the characteristic values of data belonging to different levels of measurement. Mean, variance, standard deviation, median, range, geometric mean, harmonic mean, variation coefficient.
4. Reports, OLAP cubes and pivot diagrams, OLAP Online Analytical Processing.
5. Normal distribution as a model. Cumulative probability and density function. Standard values and regularities of normal distribution.
6. Standard distribution, t- distribution, F- distribution, Chi-square distribution.
7. Hypothesis analyses.
8. General linear models (GLM) 1.
9. General linear models (GLM) 2.
10. Post hoc multiple comparisons for observed means.
11. Correlation analyses. Bivariate correlations.
12. Regression analysis, concept, bivariate linear regression.
13. Multiple linear regression, technics of initiating independent variables.
14. Nonlinear regression. Model expressions. Estimation method: sequential quadratic programming or Levenberg-Marquard algorithm. Parameter estimates and residual sum of squares.

**practices:**

1. Randomising. Collecting environmental data, sampling methods
2. Data transformation procedures: sort cases, select cases, aggregate data, merge files.
3. Mean, variance, standard deviation, median, range, geometric mean, harmonic mean, variation coefficient. Standard error of mean. Confidence intervals.
4. Data portrayal, graphs and other diagrams.
5. Standard values and regularities of normal distribution. Tests of normal distribution.
6. Standard distribution, t- distribution, F- distribution, Chi-square distribution.
7. . Compare means: u-test, one sample t-test, independent-samples t-test, paired-samples t-test, one-way ANOVA.
8. One-way models
9. Multi-factoral (two and three factors) models
10. Post hoc multiple comparisons for observed means.
11. Bivariate correlations. Applicability conditions.
12. Bivariate linear regression.
13. Multicollinearity diagnostics, problem.
14. Sum of squares for regression, residual, uncorrected total and corrected total, parameter estimates, asymptotic standard errors, and asymptotic correlation matrix of parameter estimates.

**Literature, handbooks**

Robert I. Kabacoff: R in Action, Second Edition Data analysis and graphics with R. May 2015 ISBN 9781617291388 608 pages printed in black & white

Joaquim P. Marques de Sá (2007): Applied Statistics Using SPSS, STATISTICA, MATLAB and R

**Technologies of animal origin foods, MTBE7026A**

ECTS Credit Points: 3

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

Type of exam: oral exam

**Requirements:**

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

- for a grade: Oral exam

**Summary of content - theory**:

In the course students learn about the importance of meat consumption, the current state of meat production in the world. They get to know the factors that affect meat quality. They learn the technology of meat processing, the optimal use of additives used in the production process. They get a picture of egg production, fish farming, and fish processing, as well.

**lectures:**

 Week 1: Meat production and meat consumption of the world and Hungary.
Week 2: The chemical composition of the meat, its nutritional and physiological significance.
Week 3: The physiology of slaughtering and the processes in the meat.
Week 4: Sensory, nutritional quality of meat, food safety and technological factors.
Week 5: Qualification of slaughtered animals.
Week 6: Production and processing of large slaughter animals.
Week 7: Production and processing of small slaughter animals.
Week 8: Technologies for whole-muscle brine-injected products, cooked sausages.

 Week 9: Technologies for raw fermented salami, non-fermented salami,

 Week 10: Technologies for burgers, patties and crumbed products
Week 11: Packing of meat and meat products.
Week 12 Quality assurance in meat production and processing
Week 13: Production and industrial processing of eggs.
Week 14: Fish production and fish consumption. Industrial processing of fish.

**Literature, handbooks**

Meat Science: An Introductory Text 2 nd edition ISBN 9780851994246

Muscle Development of Livestock Animals: Physiology, Genetics and Meat Quality, [Marinus Te Pas](https://www.amazon.co.uk/s/ref%3Ddp_byline_sr_book_1?ie=UTF8&text=Marinus+Te+Pas&search-alias=books-uk&field-author=Marinus+Te+Pas&sort=relevancerank) [Henk Haagsman](https://www.amazon.co.uk/s/ref%3Ddp_byline_sr_book_2?ie=UTF8&text=Henk+Haagsman&search-alias=books-uk&field-author=Henk+Haagsman&sort=relevancerank) [Maria Everts](https://www.amazon.co.uk/s/ref%3Ddp_byline_sr_book_3?ie=UTF8&text=Maria+Everts&search-alias=books-uk&field-author=Maria+Everts&sort=relevancerank), CABI Publishing, , ISBN-10: 9780851998114

Meat products handbookPractical science and technology, G. Feiner, , **eBook ISBN:** 9781845691721, Woodhead Publishing, 2006.

**Technology of baking and pasta industry, MTBE7035A**

ECTS Credit Points: 3

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

Type of exam: written exam

**Requirements:**

- for signature: Participating in 60% of the practices.

- for a grade: Written exam.

 **lectures:**

1. The history of the baking industry, its place in the cereals ceramics. Grouping of bakery products. Description of baking ingredients. Physical, chemical and rheological parameters of flour in the baking industry. Presentation of type of flour.
2. The system of bakery additives and auxiliary materials, their purpose and their effect on the parameters of the products and technology.
3. Preparation of raw materials. Methods of dough making and dough kneading. Physical and chemical processes occurring during kneading and baking time. The baking of the dough.
4. The purpose, methods and tools of dough processing. Method of baking, the effect of the tool used and the baking parameters on the quality products. Cooling, packaging, storage. Bread defects and their prevention.
5. Specialty products made from wet dough and the quality (MÉ 2-81/02) and Specialty products made from milk dough and the quality (MÉ 2-81/03). Enriched dough and the quality (MÉ 2-81/04). Egg-enriched dough and the quality (MÉ 2-81/05).
6. Shortcrust/friable dough and the quality (MÉ 2-81/06). Products from puff/flaky pastry dough and the quality (MÉ 2-81/07). Frozen baking products and the quality.
7. Other baking products: biscuits, breadcrumbs wafers etc.
8. Specialty bakery products, methods and modes on the World – traditional products from Europe, America, Asia, Australia and Africa.
9. The history of the pasta production. Importance of pasta production. Classification of dry pasta products.
10. Basic ingredients, additives and auxiliary materials of the pasta industry, packaging forms and materials.
11. The pasta technology. Preparation of basic ingredients, additives and auxiliary materials.
12. Pressing and shaping of the pasta. Stretching, pressing, cutting of the size. Physical and chemical processing of the drying. Finishing operation of the dry pasta productions.
13. The quality requirements of dry pasta.
14. Names of the different dry pasta, special dry pasta

**Literature:**

Practical exercises for the course of baking and pasta technology, Gerda Diósi, 2019 University of Debrecen Faculty of Agricultural and Food Sciences, and Environmental Management

**Technologies of brewing and distilling industries MTBE7032A**

ECTS Credit Points: 3

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

Type of exam: written

**Requirements:**

- for signature: Successful test (60%) and participation in practices.

- for a grade: Test

**Summary of content - theory**:

The main aim of the lectures is to know the methodologies of different spirit drink productions and the requirements for raw materials. Students will know the requirements and laws and requirements relation to spirit drink and spirit drink production. Students will know the mistakes which may occur in the spirit drink production, thereby affecting the quality of spirit drinks.

**lectures:**

1. Raw materials of spirit production
2. Legislation of spirit drink production
3. Malt production and malt drying
4. Mashing in brewing industry, enzymatic processes, wort production, fermentation and maturation
5. Production technologies of beer beverages
6. Raw materials of “pálinka” fruit spirit production, legislation of production
7. Production of fruit “pálinka”, operation of mashing and distillation
8. Technologies of production in red, white and rose wine production
9. Production of champagne
10. Production of liqueur
11. Production of whisky, vodka and brandy
12. Production of gin and cognac
13. Mistakes in spirit drink production
14. Test

**Summary of content - practice**:

The main aim of the practices is to know the steps of beer production and the analytical tests. Additional aim to know the steps of “pálinka” and other spirit drink production and the determination of quality analysis of these drinks.

**practices:**

1. Grouping of different beer types
2. Brewing equipment and ingredient
3. Brewing I. (British Pale Ale)
4. Brewing II. (Pilsner)
5. Brewing III. (Porter)
6. Mash preparation (“pálinka” production)
7. Production of home-made beverages
8. Sampling and sample preparation of spirit drinks
9. Quality analysis of beers
10. Mineral analysis of spirit drinks
11. Quality analysis of wines and bitters
12. Calculation of different quality parameters of spirit drinks
13. Flow diagram
14. Manufacturing formula

**Literature, handbooks**

Ted Goldammer (2008): The Brewer's Handbook. A Complete Book to Brewing Beer. Apex Publishers. (ISBN: 978-0-9675212-3-3)

Andrew G.H. Lea, John Piggott (2003): Fermented Beverage Production. Kluwer Academic/Plenum publishers. (ISBN: 0-306-47275-9)

Keith Grainger (2008): Wine production. Vine to bottle. John Wiley and Sons Inc. (ISBN: 9781405173544

**Technology of customer goods and confectionery industry, MTBE 7034A**

ECTS Credit Points: 3

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

Type of exam: written exam

**Requirements:**

- for signature: Participation in practices.

- for a grade: written exam

**Summary of content - theory**:

Consumer goods, luxury items (coffee, tea, cocoa and confectionery) are important products of food industry having relatively stable position in the consumption basket. This subject is aimed to make a systematic summary about their certification, primary and secondary processing, as well as health effects.

**lectures:**

1. Coffee. Origin, morphology, types, quality parameters, ingredients, chemical compounds.
2. Primary processing of coffee, dry and wet process, roasting.
3. After treatment of coffee, coffee extracts, decaffeinated coffee, alternative coffees, café cultures.
4. Cacao tree, cacao bean, ingredients, primary processing, roasting.
5. Storing of cacao liquor, producing chocolate mass.
6. Conching, rheological properties, tempering, polymorphism of cacao-butter.
7. Chocolate producing machines, quality parameters, cocoa powder production.
8. Tea-plant, active ingredients, tea varieties.
9. Quality of tea leaves, green and black tea production and classification.
10. Characteristic of blended tea, tea specialties, packaging, infusion types.
11. Methods of confectionery: solving, concentration, separation.
12. Methods of confectionery: drying, roasting, grinding, forming.
13. Manufacturing of sweets, marshmallow and jelly.
14. Manufacturing of caramel, brittle, marzipan and dragée, fruit processing for confectionery.

**practices:**

1. Practical implementation of coffee processing
2. Coffee brewing technologies
3. Practical implementation of cacao processing
4. Production of chocolate
5. Practical implementation of tea processing
6. Tea brewing technologies
7. Production of hard candies
8. Production of hard candies
9. Production of marshmallows
10. Production of marshmallows
11. Production of jellies
12. Production of jellies
13. Production of caramels
14. Production of caramels

**Literature, handbooks**

Emmanuel Afoakwa – Chocolate Science and Technology. 2010. Wiley-Blackwell. 9. 275.

F.Á. Mohos (2010) Confectionery and Chocolate Engineering (Principles and Applications), A John Wiley & Sons, Ltd., Publication. p. 688.

Astrid Nehlig – Coffee, Tea, Chocolate, and the Brain. Edited. 2004 by CRC Press LLC

Yukihiko Hara – Green Tea. Health Benefits and Applications. MARCEL DEKKER, INC. NEW YORK 2001.

Jean Nicolas Wintgers – Coffee: Growing, Processing, Sustainable Production: A Guidebook for Growers, Processors, Traders, and Researchers. Ed. Wiley-VCH, 2009.

**Technology of vegetable oil and animal fat industry, MTBE7033**

ECTS Credit Points: 3

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

Type of exam: written exam

**Requirements:**

- for signature: -

- for a grade: written exam

**Summary of content - theory**:

Course objectives: to provide practical up-to-date information on oil and fat processing including chemical structure, conventional and special raw materials, typical sources for the industry, processing techniques and technologies and economics and market aspects, tendencies. The course provides information to improve the knowledge and the practical skills of the students.

**lectures:**

1. Food safety, Food quality, Food processing, Food economic
2. Food, non-food, new-food

# Quality of cereals (wheat, rye, triticale, oats, barley, corn/maize, rice, sorghum, millet)

1. Storage of cereals, mill technology
2. Quality and quantity parameters of wheat flour
3. Baking technology (bread, pasta), flour
4. Corn/maize processing
5. Starch technology
6. Quality and quantitative parameters of potato, potato processing and products
7. Oil technology, quality and quantitative parameters of oils
8. Sugarbeet processing, sugar technology
9. Confection industry (candy, chocolate)
10. Production of malt, beer production
11. Fermentation industries: alcohol, fuel (bioethanol), yeast production

**Literature, handbooks**

Diósi G., Stündl L. (2019): Practical exercises for the course of Oil and fat technology. – Textbook. University of Debrecen, Faculty of Agricultural and Food Sciences, and Environmental Management

Talati, A: Extraction Methods Of Natural Essential Oils. Method. February 2017. DOI: 10.13140/RG.2.2.18744.34564

Anon: Production of Lipids From Natural Sources. <http://ocw.nagoya-u.jp/files/1/chap2.pdf>

**Theory of measurement and experimental design, MTBE7041A**

**Name and title of the person responsible for the subject:** Dr. Endre Máthé, associate professor PhD

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

**Name and level of the program:** Food safety and quality engineering MSc

**Subject type:** optional

**Teaching timetable of the subject, type of examination:** 2 lect. + 2 pract., oral

**Credit value of the subject:** 3

**Purpose of teaching the subject:**

The basis of successful food development is the correctly applied experimental design, which is based on the “STEM” (Science-Technology-Engineering-Mathematics)-specific professional education and values. The logical system of “STEM” type research is reviewed, emphasizing the coherence between questioning and the experimental model, and the importance of evaluating the implementation of experiments. The peculiarities of “STEM” type verbal and nonverbal communication are being presented.

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

**LECTURES**:

1-2. The STEM- specific professional culture and values.

3-4. Research planning and implementation: choosing the right object to study, sample size allocation and the statistical methods, documentation of observations and hypothesis analysis.

5-6. The STEM type of observation and research logics. The direct and indirect proofs type of research data.

7-8. Data collecting and interpreting. Analysis of research data: descriptive statistics and correlation analysis; publication of numerical data.

9-11. Research publications types and their content, scientific writing style and ethical considerations.

12-14. Trends of food development. The role of preventive and therapeutic nutrition in food development.

**PRACTICALS**:

1-2. STEM specific informatics databases

3-4. Elaboration of research plans for food prototype development based on technological considerations and personalized nutrition.

5-8. Preparation and discussion of scientific presentations and publications based on theoretical considerations.

9-11. Visiting the main research and food development facilities of the faculty.

12-14. Discussions on the topics of the final research project.

**Type of mid-term examination:** participation in the practicals is mandatory. Attendance at 70% of the practicals is mandatory. In case of absence, a report must be submitted by the student within two weeks from the missed practice (theoretical and practical description).

Participation in the practicals is a precondition for the final exam.

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

**Teaching aids:** lecture specific PPTs, research/review papers

**Recommended literature:**

• Adams, D.S. (2003). Lab Math. A handbook of measurements, calculations and other quantitative skills for use at bench. Cold Spring Laboratory Press. Cold Spring Harbour, New York. ISBN 0-87969-634-6.

• Davis, M. (1996). Scientific papers and presentations. Academic Press. San Diego, London. ISBN: 0-12-206370-8.

• Lazic, Z. (2004). Design of experiments in chemical engineering. A practical guide. WILEY-VCH Verlag Gmbh, Wienhelm

• Leedy, PD , Ormrod, JE (2015).Practical Research: Planning and Design, Enhanced Pearson eText -- Access Card (11th Edition). Pearson Ltd., ISBN-13: 978-0133747188

• Gratzer, W. (2002). Eurekas and Euphorias. The Oxford book of scientific anecdotes. Oxford University Press, Oxford. ISBN: 0-19-280403-0.

**Unit operations in food processing I. MTBE7013BA**

ECTS Credit Points: 5

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

Type of exam: written exam

**Requirements:**

- for signature: Participate on the practices and successful practice tests (min 60%). During the semester, the student may write 3 tests containing theoretical questions, based on which he/she may get an offered mark for the exam. In addition, students have to write 2 tests containing questions connected to the topics of the practice (seminar), and they will get the mark for the practice (seminar) based on these tests.

- for a grade: written exam

**Summary of content - theory**:

Within the framework of Unit operations in food processing the flow of fluids, separation, homogenization and transport processes are educated. In the lectures mathematical description, equipment and conditions of the flow of fluids, separation processes, homogenization processes and transport (solid agglomerations) processes operations are discussed.

**lectures:**

1. General description of the flow of fluids
2. Reynolds number, equivalent pipe diameter, principle of continuity
3.Bernoulli equation
4. Fluid transport (pumps, fans, compressors)
5. General description of the mechanical separations, gravity sedimentation
6. Centrifugal sedimentation, types of centrifuges, cyclones, hydrocyclones
7. Filtration, filtering equipment
8. Pressing, pressing machines
9. Homogenization, mixing, mixers

10. Emulsification, emulsifying equipment
11. Crushing, crushers
12. Pounding, pounding machines
13. Fluidization
14. Pneumatic transport

**Summary of content - practice**:

In the frame of the exercise classes equations, methods and practical mathematical models are described. In the practice application of fundamental laws and equations takes place with different mathematical models and equations.

**practices:**

1. Practical calculation tasks in the topics of Reynolds number, equivalent pipe diameter, principle of continuity
2. Applications of Bernoulli equation in the food industry calculations I.
3. Applications of Bernoulli equation in the food industry calculations II.
4. Calculations of the fluid transport
5. Practical calculation tasks in the topics of mechanical separations, gravity sedimentation
6. Practical calculation tasks and food industry applications of the centrifugal sedimentation
7. Practice Test I.
8. Food industry practice examples and calculations of homogenization and mixing
9. Food indsutry practice examples of emulsifying-, crushing equipment
10. Food indsutry practice examples of pounding machines
11. Practical calculation tasks in the topics of fluidization I.
12. Practical calculation tasks in the topics of fluidization II.
13. Practice Test II.

**Literature, handbooks**

Food Process Engineering and Technology. 2nd Edition. Authors: Zeki Berk. Hardcover ISBN: 9780124159235. eBook ISBN: 9780124159860

Unit Operations in Food Processing, Second Edition 2nd Edition by R.L.Earle eBook ISBN: 9781483293103

Introduction to Food Engineering, Fifth Edition (Food Science and Technology) 5th Edition by R Paul Singh (Author), Dennis R. Heldman (Author)  ISBN-13: 978-0123985309

**Unit operations in food processing II. MTBE7045BA**

**A tantárgyfelelős neve, beosztása: Prof. Dr. Kovács Béla – egyetemi tanár**

**Szak neve: Élelmiszermérnök BSc**

**Tantárgy típusa: kötelező**

**A tantárgy oktatási időterve, vizsga típusa: 3. félév (2+2), gyakorlati jegy**

**A tantárgy kredit értéke: 4**

**A tantárgy oktatásának a célja:**

Within the framework of Unit operations in food processing II course the heat transfer operations and the thermal processes in the food processing are educated.

**A tantárgy tartalma** (14 hét bontásban):

1. Intoduction to the thermal operations of food processing, basic thermal definitions
2. Thermal properties of foods
3. Conductive heat transfer
4. Convective heat transfer
5. Heat transfer by radiation
6. Steady-State Heat Transfer
7. Unsteady-State Heat Transfer
8. System for Heating and Cooling Food Products
9. Microwave and ohmic heating
10. Thermal Processes, Methods and Equipment
11. Frying, Baking, Roasting
12. Refrigeration
13. Food Freezing
14. Effect of Temperature on Food Spoilage

**Évközi ellenőrzés módja** (*a foglalkozásokon való részvétel előírásai és félévközi ellenőrzésének módja, a vizsgára bocsátás és aláírás feltételei*):

During the semester, the student may write 3 tests containing theoretical questions, based on which he may get an offered mark for the exam. In addition, students have to write 3 tests containing questions connected to the topics of the practice (seminar), and they will get the mark for the practice (seminar) based on these tests.

**Számonkérés módja** (*félévi vizsgajegy kialakításának módja – beszámoló, gyakorlati jegy, kollokvium, szigorlat*): **kollokvium**

**Oktatási segédanyagok:**

ppt presentation; books

**Ajánlott szakirodalom:**

Food Process Engineering and Technology. 2nd Edition. Authors: Zeki Berk. Hardcover ISBN: 9780124159235. eBook ISBN: 9780124159860

Unit Operations in Food Processing, Second Edition 2nd Edition by R.L.Earle eBook ISBN: 9781483293103

Introduction to Food Engineering, Fifth Edition (Food Science and Technology) 5th Edition by R Paul Singh (Author), Dennis R. Heldman (Author) ISBN-13: 978-0123985309

 Fundamentals of Food Process Engineering (Food Science Text Series) 4th ed. 2018 Edition

by Romeo T. Toledo (Author), Rakesh K. Singh (Author), Fanbin Kong (Author), ISBN 978-3-319-90091-1

**Weekly practical assignment 1, MTBE7H1A**

ECTS Credit Points: 0

0 hour(s) lecture and 40 hour(s) practice per semester

Type of exam: written exam

**Requirements:**

- for signature: Completion of the practical assignment

- for a grade: Completing and submitting the documentation of food processing of plant-based raw materials of the relevant unit.

**Summary of content - theory**:

Course objectives: the theoretic knowledge necessary for the course is provided during the technology subjects.

**Summary of content - practice**:

Skills to be learnt: practical application of theoretic knowledge on food processing and skills improvement on food processing technologies including the use of equipment and machinery as well as the compilation of the necessary documentation.

**practices:**

1. Vegetable and fruit processing technologies 1.
2. Milling technologies 1.
3. Bakery technologies 1.
4. Pasta production technologies 1.
5. Documentation of food processing from plant-based raw materials

**Literature, handbooks**

Nirmal K. Sinha, Jiwan S. Sidhu (eds.): Handbook of fruits and fruit processing – Second edition 2012 by John Wiley & Sons, Ltd.

Nirmal K. Sinha (ed.): Handbook of vegetables and vegetable processing. 2011 Blackwell Publishing Ltd.

FAO: Wheat flour. Agribusiness Handbook 2009.

Y. H. Hui (ed.): Bakery Products Science and Technology. 2006 Blackwell Publishing

**Weekly practical assignment 2, MTBE7H2A**

ECTS Credit Points: 0

0 hour(s) lecture and 40 hour(s) practice per semester

Type of exam: written exam

**Requirements:**

- for signature: Completion of the practical assignment

- for a grade: Completing and submitting the documentation of food processing from raw materials of animal origin the relevant unit

**Summary of content - theory**:

Course objectives: the theoretic knowledge necessary for the course is provided during the technology subjects.

**Summary of content - practice**:

Skills to be learnt: practical application of theoretic knowledge on food processing and skills improvement on food processing technologies including the use of equipment and machinery as well as the compilation of the necessary documentation.

**practices:**

1. Meat processing technologies 1.
2. Dairy technologies 1.
3. Documentation of food processing from plant-based raw materials

**Literature, handbooks**

Fidel Toldrá (ed.): Handbook of meat processing. Blackwell Publishing 2010.

Heinz G. & Hautzinger P.: Meat Processing Technology for Small- to Medium-Scale Producers. FAO Bangkok, 2007

Gösta Bylund: Dairy processing handbook. Tetra Pak Processing Systems AB, S-221 86 Lund, Sweden, 2011

Ramesh C. Chandan and Arun Kilara: Manufacturing Yogurt and Fermented Milks. John Wiley & Sons, Inc. 2013

Barry A. Law & A.Y. Tamime (eds.): Technology of Cheesemaking. Blackwell Publishing Ltd., 2010

**Weekly practical assignment 3, MTBE7H3A**

ECTS Credit Points: 0

0 hour(s) lecture and 40 hour(s) practice per semester

Type of exam: written exam

**Requirements:**

- for signature: Completion of the practical assignment

- for a grade: Completing and submitting the documentation of food processing from raw materials of animal origin the relevant unit

**Summary of content - theory**:

Course objectives: the theoretic knowledge necessary for the course is provided during the technology subjects.

**Summary of content - practice**:

Skills to be learnt: practical application of theoretic knowledge on food processing and skills improvement on food processing technologies including the use of equipment and machinery as well as the compilation of the necessary documentation.

**practices:**

1. Vegetable and fruit processing technologies 2.
2. Milling technologies 2.
3. Bakery technologies 2.
4. Pasta production technologies 2.

Documentation of food processing from plant-based raw materials

**Literature, handbooks**

Nirmal K. Sinha, Jiwan S. Sidhu (eds.): Handbook of fruits and fruit processing – Second edition 2012 by John Wiley & Sons, Ltd.

Nirmal K. Sinha (ed.): Handbook of vegetables and vegetable processing. 2011 Blackwell Publishing Ltd.

FAO: Wheat flour. Agribusiness Handbook 2009.

Y. H. Hui (ed.): Bakery Products Science and Technology. 2006 Blackwell Publishing

S.B. Navaratne: Pasta Products Technology University of Sri Jayewardenepura 2015.

**Weekly practical assignment 4, MTBE7H4A**

ECTS Credit Points: 0

0 hour(s) lecture and 40 hour(s) practice per semester

Type of exam: written exam

**Requirements:**

- for signature: Completion of the practical assignment

- for a grade: Completing and submitting the documentation of food processing from raw materials of animal origin the relevant unit

**Summary of content - theory**:

Course objectives: the theoretic knowledge necessary for the course is provided during the technology subjects.

**Summary of content - practice**:

Skills to be learnt: practical application of theoretic knowledge on food processing and skills improvement on food processing technologies including the use of equipment and machinery as well as the compilation of the necessary documentation.

**practices:**

1. Meat processing technologies 2.
2. Dairy technologies 2.
3. Documentation of food processing from plant-based raw materials

**Literature, handbooks**

Fidel Toldrá (ed.): Handbook of meat processing. Blackwell Publishing 2010.

Heinz G. & Hautzinger P.: Meat Processing Technology for Small- to Medium-Scale Producers. FAO Bangkok, 2007

Gösta Bylund: Dairy processing handbook. Tetra Pak Processing Systems AB, S-221 86 Lund, Sweden, 2011

Ramesh C. Chandan and Arun Kilara: Manufacturing Yogurt and Fermented Milks. John Wiley & Sons, Inc. 2013

Barry A. Law & A.Y. Tamime (eds.): Technology of Cheesemaking. Blackwell Publishing Ltd., 2010

**Zoology – MTB7003A**

ECTS Credit Points: 5

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

Type of exam: Colloquium

Requirements:

- for signature: successful seminar tests

- for a grade: successful colloquium

**Summary of content - theory**:

The target of the course is to ensure the general knowledge of students in zoology, to introduce the structure and functioning of the animal cell, the types of animal tissues, their basic structure, significance, the general definitions of reproduction and ontogenesis. Introducing the main taxonomic units, and to teach to recognize invertebrate and vertebrate species in practice. Evaluating animal species considering their nature conservation and possible economic values and to evaluate the human effects on the world of animals.

**lectures:**

1. The anatomy of animal cells and tissues
2. Animal taxonomy
3. Anatomy and taxonomy of molluscs
4. Anatomy and taxonomy of arthropods
5. Anatomy and taxonomy of insect
6. Taxonomy of insects
7. Anatomy and taxonomy of vertebrates
8. Anatomy and taxonomy of fishes
9. Anatomy and taxonomy of amphibians
10. Anatomy and taxonomy of reptiles
11. Anatomy and taxonomy of birds
12. Anatomy and taxonomy of mammals
13. Ecology, biogeography
14. Conservation biology

**practices:**

1. The basics of animal taxonomy
2. Phylum: Platyhelminthes - flatworms , Nematoda – roundworms
3. Phylum: Annelida - segmented worms
4. Phylum: Mollusca - snails, shellfish, cephalopods, Echinodermata - starfish, sea urchins
5. Phylum: Arthropoda – crustacea, crabs, arachnids, insects
6. Class of Insects 1
7. Class of Insects 1
8. Test
9. Phylum: Chordata – Fishes,
10. Class of Amphibians
11. Class of Reptiles
12. Class of Birds
13. Class of Mammals
14. Test

**Literature**

HICKMAN, C. P., ROBERTS, L. S., & LARSON, A. (1997). Integrated principles of zoology. Boston, Mass, WCB/McGraw-Hill. ISBN 10 0072909617

MILLER, S. 2019 Zoology, McGraw-Hill Higher Education, Print ISBN: 9781259880025

# **Internship**

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

# **Work and Fire Safety Course**

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

Registration in the Neptun system by the subject: MUNKAVEDELEM

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

# **Physical Education**

According to the Rules and Regulations of University of Debrecen a student has to complete Physical Education courses at least in two semesters during the Bachelor training and one semester during the Master training. Our University offers a wide range of facilities to complete them. Further information is available from the Sport Centre of the University, its website: [http://sportsci.unideb.hu.](http://sportsci.unideb.hu/)

# **Thesis**

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

A student in master program has to prepare a thesis as a prerequisite of the final exam. The requirements of the thesis content, the general aspects of evaluation and the number of credits assigned to the thesis are determined by the requirements of the program. In the program the credits assigned to the thesis is 15.

The latest that thesis topics are announced by the departments for the students is the end of Week 4 of the study period of the last semester. A thesis topic can be suggested by the student as well and the head of department assigned shall decides on its acceptance.

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

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

# **Final examination (Final Exam)**

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

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

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

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

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

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

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

*Improving failed final exam*

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

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

*Final exam board*

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

# **DIPLOMA**

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

The diploma is an official document decorated with the coat of arms of Hungary which verifies the successful completion of studies in the undergraduate 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 Distinction is permitted where a student obtained grade 5 in all subjects of the final exam. The average of thesis grade, his/her exam grades and mid-semester grades during his/her studies is at least 4.00. Moreover, he/she is not permitted to have a grade worse than grade 3 during his/her studies.

**MODEL CURRICULUM OF FOOD ENGINEERING BSC**

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/food-engineering-bsc>).

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| *Coordinator: Dr. Péter Sipos, professor* |
|  |  |  |  |  |  |  |  |  |  |  |  |
| **Code** | **Subject name** | **I. semester** | **II. semester** | **III. semester** | **IV. semester** | **V. semester** | **VI. semester** | **VII. semester** | **Lecturer** |
| 14 | 14 | 14 | 14 | 14 | 14 | 12 |
| lec | prac | type | credit | lec | prac | type | credit | lec | prac | type | credit | lec | prac | type | credit | lec | prac | type | credit | lec | prac | type | credit | lec | prac | type | credit |
|  | ***Prime courses*** |
| MTBE7001A | Molecular and cell biology | 2 | 2 | E | 4 |   |   |   |   |   |   | Dr. Máthé Endre |
| MTBE7002A | Organic chemistry | 2 | 1 | E | 3 | Dr. Kincses Sándorné |
| MTBE7003A | Food physics | 2 | 2 | E | 4 | Dr. Sipos Péter |
| MTBE7004A | Introduction to food safety | 2 | 0 | P | 3 | Dr. Czipa Nikolett |
| MTB7005A | Mathematics | 2 | 1 | P | 4 | Dr. Vincze Szilvia |
| MTB7006A | General and inorganic chemistry | 2 | 1 | E | 4 | Dr. Vágó Imre |
| MTB7008A | Informatics | 0 | 2 | P | 3 | Dr. Várallyai László |
| MTBE7008A | Physical chemistry |   | 2 | 2 | P | 4 | Dr. Prokisch József |
| MTB7014A | Plant physiology |   | 2 | 1 | E | 3 | Dr. Veres Szilvia |  |
| MTBE7005BA | Animal physiology | 2 | 1 | E | 3 | Dr. Stündl László, Novotniné Dr. Dankó Gabriella |  |
| MTBE7006BA | Electrotechnics | 2 | 1 | P | 3 | Dr. Harsányi Endre |  |
| MTBE7007A | Biochemistry | 2 | 1 | E | 3 | Kincses Sándorné dr. |  |
| MTBE7009A | Analytical chemistry | 2 | 2 | P | 4 | Dr. Kovács Béla |  |
| MTBE 7013BA | Unit operations in food processing I. | 2 | 2 | E | 4 | Dr. Kovács Béla |  |
| MTBE 7044A | Basic Food Engineering Skills | 2 | 1 | E | 3 | Dr. Hagymássy Zoltán |  |
| MTB7020AA | Economic sciences I. (micro- and macro economics) |   | 2 | 0 | E | 2 | Bauerné Dr. Gáthy Andrea |  |
| MTB7020BA | Economic sciences I. (EU knowledge agricultural economics | 2 | 0 | E | 2 | Dr. Harangi-Rákos Mónika |  |
| MTBE7010A | Basic of quality management | 2 | 0 | E | 3 | Dr. Peles Ferenc |  |
| MTBE7011A | Basic principles of food mechanics | 2 | 2 | P | 4 | Dr. Vántus András |  |
| MTBE7012A | Food colloidics | 2 | 0 | E | 3 | Dr. Kovács Béla |  |
| MTBE7045A | Unit operations in food processing II. | 2 | 2 | P | 4 | Dr. Kovács Béla |  |
| MTBE7014A | Food chemistry | 2 | 1 | P | 3 | Kincses Sándorné dr. |  |
| MTBE7015A | Raw materials of food processing | 2 | 0 | E | 3 | Dr. Gerda Diósi |  |
| MTBE7016A | Introduction to microbiology | 2 | 1 | P | 3 | Dr. Karaffa Erzsébet |  |
| MTB7024AA | Economic sciences II. (farm business management) |   | 1 | 1 | P | 2 | Dr. Posta László |  |
| MTB7024BA | Economic sciences II. ( finance and accounting) | 1 | 1 | P | 2 | Dr. Kvancz József |  |
| MTBE7017BA | Unit operations in food processing III. | 2 | 2 | P | 4 | Dr. Kovács Béla |  |
| MTBE7019A | Industrial microbiology | 2 | 1 | E | 3 | Dr. Karaffa Levente |  |
| MTBE7020A | Instrumental analytics | 2 | 2 | E | 4 | Dr. Kovács Béla |  |
| MTBE7021A | Processing technologies of agricultural crops | 2 | 0 | E | 4 | Dr.Diósi Gerda |  |
| MTBE7022BA | Measurement technics and automatisation | 2 | 2 | E | 4 | Dr. Sipos Péter |  |
| MTB7026AA | Economic sciences III. (communication, organisation and logistics, management skills, marketing) |   | 2 | 0 | E | 2 | Dr. Juhász Csilla |  |
| MTB7026BA | Economic sciences III. (extension service) | 2 | 0 | E | 2 | Dr. Pető Károly |  |
| MTB7028A | Statistics | 1 | 1 | P | 3 | Dr. Huzsvai László |  |
| MTBE7023A | Food analytics | 2 | 2 | P | 4 | Dr. Czipa Nikolett |  |
| MTBE7024A | Food microbiology | 2 | 2 | P | 4 | Dr. Peles Ferenc |  |
| MTBE7025A | Food industry economics | 1 | 1 | E | 3 | Dr. Buzás Ferenc Ede |  |
| MTBE7026A | Technologies of animal origin foods | 2 | 0 | P | 3 | Dr. Rózsáné Dr. Várszegi Zsófia |  |
| MTBE7027A | Dairy industry technology | 2 | 0 | P | 3 | Dr. Stündl László |  |
| MTBE7028A | Processing and preservation of horticultural products | 2 | 0 | E | 3 | Dr. Babka Beáta |  |
| MTBE7029A | Technologies of wine and fruit juice making |   | 2 | 2 | E | 3 | Dr. Karaffa Erzsébet |  |
| MTBE7030A | Food hygienie | 1 | 1 | P | 3 | Dr. Pálfyné Dr. Vass Nóra |  |
| MTB7029A | Regulation and administration of agriculture | 2 | 0 | E | 3 | Dr. Andorkó Imre |  |
| MTBE7031A | Food industry technologies and quality assurance | 2 | 1 | P | 3 | Dr. Czipa Nikolett |  |
| MTBE7032A | Technologies of brewing and distilling industries | 1 | 2 | P | 3 | Dr. Czipa Nikolett |  |
| MTBE7033A | Technology of vegetable oil and animal fat industry | 1 | 2 | P | 3 | Dr. Stündl László |  |
| MTBE7034A | Technology of customer goods and confectionary industry | 1 | 2 | P | 3 | Dr. Babka Beáta |  |
| MTBE7035A | Technology of baking and pasta industry | 1 | 0 | P | 3 | Dr. Diósi Gerda |  |
|   | ***Number of hours:*** | ***12*** | ***9*** | ***25*** | ***16*** | ***11*** | ***27*** | ***18*** | ***6*** | ***27*** | ***12*** | ***9*** | ***23*** | ***16*** | ***6*** | ***27*** | ***11*** | ***10*** | ***24*** |  |   |  |
| MTBE7H1A | Weekly practical assignment |   |   | 0 | 40 | S |   |   |   |   |   | Dr. Stündl László |  |
| MTBE7H2A | Weekly practical assignment |   | 0 | 40 | S |   | Dr. Stündl László |  |
| MTBE7H3A | Weekly practical assignment |   | 0 | 40 | S |   | Dr. Stündl László |  |
| MTBE7H4A | Weekly practical assignment |   | 0 | 40 | S |   | Dr. Stündl László |  |
|   | ***Number of hours:*** |  |  | ***0*** | ***40*** |  | ***0*** | ***40*** |  | ***0*** | ***40*** |  | ***0*** | ***40*** |  |   |   |   |   |   |   |   |  |
|   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |   |   |   |   |   |   |   |  |
|   | ***Subjects of free choice*** |  |
| MTBE 7015A | Environmental management |  |  |  |  | 2 | 0 | E | 3 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Dr. Juhász Csaba |  |
| MTBE7036A | Quality control of plant origin food products |   |   |   |   | 1 | 1 | E | 3 |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   | Dr. Ungai Diána |  |
| MTBE7037A | Quality control of animal origin food products |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   | 1 | 1 | E | 3 |   |   |   |   |   |   |   |   | Dr. Rózsáné Dr. Várszegi Zsófia |  |
| MTBE7038A | Nutrition knowledge |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   | 2 | 0 | E | 3 |   |   |   |   | Kincses Sándorné dr. |  |
| MTBE7039A | Packaging technology |   |   |   |   |   |   |   |   |   |   |   |   | 2 | 0 | P | 3 |   |   |   |   |   |   |   |   |   | Dr. Kovács Béla |  |
| MTBE7040A | Functional foods |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   | 3 | 0 | E | 3 |   |   |   |   | Dr. Csapó János |  |
| MTBE7041A | Theory of measurement and experimental design |   |   |   |   |   |   |   |   | 2 | 2 | P | 3 |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   | Dr. Máthé Endre |  |
| MTBE7042A | Food process control systems |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   | 1 | 1 | E | 3 |   |   |   |   |   |   |   |   | Dr. Sipos Péter |  |
| MTBE7018A | Modern bioanalytical methods |   |   |   |   |   |   |   |   |   |   |   |   | 1 | 2 | G | 3 |   |   |   |   |   |   |   |   |   |   |   |   | Gálné Dr. Remenyik Judit |  |
|  | ***Number of hours:*** |  |  |  |  | ***3*** | ***1*** | ***6*** | ***2*** | ***2*** | ***3*** | ***3*** | ***2*** | ***6*** | ***2*** | ***2*** | ***6*** | ***6*** | ***0*** | ***6*** |  |  |  |  |  |  |
|   |   |   |   |   |   |   |   |   |   |   |   |  |
|   | ***Compulsory subjects*** |  |
| MTB7NY1A | Professional language skills I. | 0 | 4 | P | 3 |   |   |   |   |   |   | Dr. Czellér Mária |  |
| MTB7NY2A | Professional language skills II. |   | 0 | 4 | P | 3 | Dr. Czellér Mária |  |
| SI-005 | Physical education | 0 | 2 | A | 0 |   | Lecturer |  |
| SI-005 | Physical education |   | 0 | 2 | A | 0 | Lecturer |  |
| MTBE7NG1A | Professional practice\* | 0 | 60 |   | **0** | Dr Stündl László |  |
| MTBE7NG2A | Professional practice\* |   | 0 | 60 |   | **0** | Dr. Stündl László |  |
| MTB7D1A | Thesis project work I. |   | 0 | 2 | G | 7 |   | Lecturer |  |
| MTB7D2A | Thesis project work II. |   | 0 | 2 | G | 8 | Lecturer |  |
|  | ***Number of hours:*** | ***0*** | ***6*** | ***3*** | ***0*** | ***6*** | ***3*** |  | ***0*** | ***0*** |  |  | ***0*** | ***2*** | ***7*** | ***0*** | ***2*** | ***8*** | ***160*** |  |  |  |  |
|   | *Total number of credits for compulsory subjects* | 28 | ***30*** | ***27*** | ***23*** | ***34*** | ***32*** |  | 174 |  |
|   | *Total number of credits for free choice subjects* | **0** | **6** | **3** | **6** | **6** | **6** |   | 6 (2 subjects with 3 creidts each have to be completed) |  |
| MTB7GYAKBSC | Internship |   |   |   |   |   |   |   |  |   |   |   |  |   |   |   |  |   |   |   |  |   |   |   |  | 0 | 480 | G | 30 | 30 |  |
|   | **Total credits** |  |  |  |  |  |  |   | 174 + 6 - 30 ct=210 |  |
|   | **Total number of lectures** | **12+15** | **19+18** | **18+8** | **15+11** | **16+10** | **17+12** |   |   |  |
| \* The exercises are to be completed in the summer, in a plant related to food production, testing or inspection, or in an institution, and it has to be taken up in the following fall semester in the Neptun system. |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Final exam: food technology, unit operations in food processing, food industry economics |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  | E Exam |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  | P Practice |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  | S Signature |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |