

ERASMUS COURSES – FACULTY OF ENGINEERING 2021/2022

Course Code	
Module	
Title:	Food Preservation Techniques
Teacher:	Cecilia HODÚR, Zsuzsanna LÁSZLÓ
Contact:	hodur@mk.u-szeged.hu zsizsu@sol.cc.u-szeged.hu
Level	BSc (minimum 5 students)
Termin	spring semester (2 lessons a week) (mark: 1,3,5)
Module Aims	Aim of the course is to introduce most important parts of food preservation techniques.
Module Subject	Principles of food protection, protection of food by heating, evaporation, chilling, freezing, chemical preservation techniques, bio-preservation, new techniques used in food protection such as pulsed electric field, high pressure processing, x-rays, pulsed light, ozone, microwave, radio waves, and applications.
Number of Credits	4

Course Code	
Module	
Title:	Food Safety
Teacher:	Judit KRISCH
Contact:	krisch@mk.u-szeged.hu
Level	BSc, MSc (minimum 5 students)
Termin	fall or spring semester (2 lessons a week) (mark: 1,3,5)
Module Aims	Aim of the course is to introduce basics of food safety.
Module Subject	Definitions: definition of food, food safety. Food safety in the EU: EC regulation 178/2002. Principles of the general food law. EFSA and RASFF. HACCP. Risk assessment, management and communication. Principles of HACCP. „From farm to fork” concept: Agriculture: food safety aspects of crop cultivation and husbandry. Food safety aspects of food processing. GMP, GHP, new technologies. Distribution of foods. Food retail. Food safety aspects for the catering industry and for home made foods. Hygiene: Cleaning and disinfection in the food industry. Hygiene at home.
Number of Credits	4

Course Code	
Module	
Title:	Membrane separation techniques
Teacher:	Szabolcs KERTÉSZ
Contact:	kertesz@mk.u-szeged.hu
Level	BSc (minimum 3 students)
Termin	fall or spring semester (2 lessons a week) (mark: 1,2,3,4,5)
Module Aims	The aim of the course is to give general knowledge of the membrane technology, especially the pressure driven membrane separation processes like microfiltration (MF), ultrafiltration (UF) nanofiltration (NF) and reverse osmosis (RO).
Module Subject	The students will learn and understand some laboratory and industrial membrane separation methods and their basics. The utilizations of MF, UF, NF and RO processes, the membrane fouling and methods to reduce it by different techniques will be also discussed. Pre- and post-treatments will be analyzed for the process intensification. Other scope is to teach the application of membrane techniques in laboratory and industrial scale. Furthermore, the students will be able to understand and apply novel water purification membrane separation methods in wastewater treatment and water quality analysis. To learn and use the scientific literature article databases (like Scopus and Science direct) of the membrane separation techniques (related to water purification and food industry) is an important aim of the course.
Number of Credits	4

Credits	
Course Code	
Module	
Title:	Meat and Meat Products Technology
Teacher:	Dóra BENCSIK
Contact:	bencsikd@mk.u-szeged.hu
Level	BSc (minimum 5 students)
Termin	fall or spring semester (2 lessons a week) (mark: 1,3,5)
Module Aims	Aim of the course is to introduce most important parts of meat products technology.
Module Subject	Physical, chemical, microbiological and histological characteristics of meat, conversion of muscle to meat, preservation methods; meat refrigeration and freezing technologies, meat processing technologies; curing, smoking, emulsification, fermentation, canning, restructured meat products, meat packaging technology, quality control analysis in meat and meat products.
Number of Credits	4

Course Code	
Module	
Title:	Food Toxicology
Teacher:	Dóra BENCSIK
Contact:	bencsikd@mk.u-szeged.hu
Level	BSc (minimum 5 students)
Termin	spring semester (2 lessons a week) (mark: 1,2,3,4,5)
Module Aims	The aim of the course is to provide students with the basis of food toxicology and their role in modern food science. Within the subject matter, the basic concepts of toxicology are discussed. Students can overcome the toxicological risks that arise when producing, processing and consuming food.
Module Subject	Principles of food toxicology, food additives, micotoxins, plant toxins, animal toxins, toxicological risks of food producing, processing and consumption, pesticide residues, veterinary products, plant protection products.
Number of Credits	4

Course Code	
Module	
Title:	Baking Technology
Teacher:	P. Balázs SZABÓ
Contact:	szpb@mk.u-szeged.hu
Level	BSc (minimum 5 students)
Termin	fall semester (2 lessons a week) (mark: 1,3,5)
Module Aims	Aim of the course is to introduce most important parts of baking technology.
Module Subject	Physical and chemical properties of cereal, cereal quality criteria, storage of cereal, milling of cereal, flour quality criteria, rheology and chemistry of dough, bread making technology, macaroni production technology, biscuit production technology, bulgur production technology, breakfast cereals and snack food technology, quality control analyses in cereals and cereal products Will be discussed the main raw materials of bread, particularly the flour, the yeast, the salt, and the water. Learn about the technology, scaling the ingredients, activates the yeast. Important part of the course is the mixing (mixing times, dough temperature, structure of the dough, dough kneading - kneader types, different methods - straight dough method; sponge and dough method - sourdough method -, sponge fermentation, sponge parameters, gluten development, and structure). We analyzed the baking process (heat transfer, steaming at the beginning of the baking process, temperature, baking time).
Number of Credits	4

Course Code	
Module	
Title:	Dairy Technology
Teacher:	József CSANÁDI
Contact:	csanadi@mk.u-szeged.hu
Level	BSc (minimum 5 students)
Termin	fall semester (2+1 lessons a week) (mark: 1,2,3,4,5)
Module Aims	Aim of the course is to introduce the milk production, and the processing of raw milk.
Module Subject	Basic information of milk production, collection and reception. General treatments of milk processing (clarification, separation, fat standardization, homogenization and pasteurization). Production of market milk type milk product. Butter making. Production of fermented milk products. Cheese varieties, introduction to cheese making, the steps of the cheese making, the utilization of whey, the mechanization of cheese making. Production of milk powder and ice cream.
Number of Credits	4+2

Course Code	
Module	
Title:	Chocolate World
Teacher:	Ernő GYIMES
Contact:	gyimes@mk.u-szeged.hu
Level	BSc (minimum 5, maximum 10 students)
Termin	fall semester (2 lessons a week) (mark: 1,3,5)
Module Aims	Aim of the course is to introduce most important parts of cocoa processing and chocolate manufacturing.
Module Subject	Discovering of cocoa and spreading around the World. Introduction to cocoa tree, bean and the primary processing of cocoa. Different type of cocoa, flavour, taste. Chemical composition of cocoa bean. White, milk and plain chocolate: differences and similarities. Chocolate manufacturing and industrial processing. Cocoa butter and its alternatives. Moulding and enrobing of chocolate. Packaging of chocolate bar and pralines.
Number of Credits	4

Course Code	
Module	
Title:	New Ways in Environmental Management and Waste Management
Teacher:	Gábor VERÉB, Szabolcs KERTÉSZ, Sándor BESZÉDES
Contact:	veregb@mk.u-szeged.hu ; kerteszb@mk.u-szeged.hu ; beszedes@mk.u-szeged.hu
Level	BSc (minimum 5 students)
Termin	spring semester (2 lessons a week) (mark: 1,2,3,4,5)
Module Aims	The aim of the course is to give a general knowledge of environmental management and waste management in details. It is also important to investigate the possible solutions, the new methods and technologies, the technical background of modern environmental protection.
Module Subject	Different areas of environmental management, for example air and water quality management and air and soil protection. Concepts and application examples of circular economy, typical waste and by-products streams of some manufacturing technologies. Basics of waste (fluid, solid) treatments. Basics of handling and utilization of biowastes. Renewable energy sources. Direct and indirect energetic utilization of wastes. Waste-to-energy concepts: technologies, possibilities and drawbacks.
Number of Credits	4

Course Code	
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Module	
Title:	Environmental Economy
Teacher:	Szabolcs KERTÉSZ; Sándor BESZÉDES
Contact:	kerteszz@mk.u-szeged.hu beszedes@mk.u-szeged.hu
Level	BSc, MSc (minimum 5 students)
Termin	fall semester (2 lessons a week) (mark: 1,2,3,4, 5)
Module Aims	The aim of the course is to give general knowledge of natural resources, market failure of natural resources, environmental problems, environmental systems, technical description of environmental technologies and possible solutions, water and wastewater treatment processes, waste management, waste to energy concept, biomass utilization, renewable energy sources.
Module Subject	Overview of Environmental Problems and Economy. Basics of Environmental Management. Renewable Energy Sources. Waste and By-products Streams in Food Processing Technologies. By-product Utilization in Food Industry. Controlled biological treatments and processes for bio-waste handling and utilization. Overview of Waste to Energy (W2E) Concept. Environmental Pollutants (source, types). Basics of Wastewater Treatment Technologies. Novel Processes in Food Industry Wastewater Purification. Basics of Air Purification Methods.
Number of Credits	2

Course Code	
Module	
Title:	Transport Phenomena in Food Industry I.
Teacher:	Szabolcs KERTÉSZ; Cecilia HODÚR, Sándor BESZÉDES
Contact:	kerteszz@mk.u-szeged.hu
Level	MSc, BSc
Termin	spring semester (2 lessons a week) (mark: 1,2,3,4,5)
Module Aims	The aim of course is to better understand of transport phenomena and give knowledge of the phenomenological and engineering principles of momentum- and heat transfer, that are the basis of the correct application of different food manufacturing processes, maintain the product quality and achieve enhanced energetic efficiency of the food processing technologies.
Module Subject	Food processing aspects of momentum transfer phenomena: momentum transfer variables, energy balances, laminar and turbulents flows, differential equations of momentum transfer. Fluid flow of Newtonian and non-Newtonian fluids. Basics of rheological behavior of foods and their raw materials. Thermal properties of foods. Governing equations for heat transfer by conduction, convection and radiation. Differential equations of heat transfer Modeling of heat transfer.
Number of Credits	4

Course Code	
Module	
Title:	Transport Phenomena in Food Industry II.
Teacher:	Szabolcs KERTÉSZ; Cecilia HODÚR, Sandor BESZÉDES
Contact:	kerteszz@mk.u-szeged.hu
Level	MSc, BSc
Termin	fall semester (2 lessons a week) (mark: 1,2,3,4, 5)
Module Aims	The aim of course is to better understand of transport phenomena and give knowledge of the phenomenological and engineering principles of heat-, and mass transfer, that are the basis of the correct application of different food manufacturing processes, maintain the product quality and achieve enhanced energetic efficiency of the food processing technologies.
Module Subject	Differential equations of heat and mass transfer modeling. Mass transfer by diffusion: steady state and unsteady state molecular diffusion in gases, liquids and solids. Mass transfer by convection: film theory, two-film theory, mass transfer coefficient. Analogies for transport phenomena. Theory and applications of thermal and non-thermal concentration process for food industry. Modeling and minimization of fouling. Study of complex transport phenomena in food dehydration processes. Theoretical background of novel food manufacturing

	processes (osmotic dehydration, ohmic heating, microwave irradiation, membrane separation).
Number of Credits	4

Course Code	
Module	
Title:	Food Branches Technology II.
Teacher:	József CSANÁDI, Dóra BENCSIK
Contact:	csanadi@mk.u-szeged.hu bencsikd@mk.u-szeged.hu
Level	BSc, MSc (minimum 5 students)
Termin	spring semester (3+1 lessons a week) (mark: 1-5)
Module Aims	To give supplement information about dairy – meat- and poultry processing based on the BSc knowledge
Module Subject	<p>Bioactive components of milk, Ice cream making, Heat treatments and its' consequences on milk properties and Dairy: technology, utilization of side products, economic and technological background of milk clotting in cheese making.</p> <p>Meat: Characteristics of raw materials and their selection by processing purpose, objective certification, Animal welfare and slaughter technology. The role of refrigeration and freezing in the preservation and processing of meat, raw materials for meat processing and their preparation for processing into economical stuffed products. Novelties of Marinated Goods and Raw Stuffed Goods.</p> <p>Poultry: The nutritional value of poultry meat. Advanced technology for poultry processing. The role of keeping and slaughtering on the quality of meat, its modern and up-to-date methods of determination. New technologies for slaughtering waterfowl. Meeting new consumer and commercial needs</p>
Number of Credits	5

Course Code	
Module	
Title:	Food Branches Machinery II.
Teacher:	József CSANÁDI, Dóra BENCSIK
Contact:	csanadi@mk.u-szeged.hu bencsikd@mk.u-szeged.hu
Level	BSc, MSc (minimum 5 students)
Termin	spring semester (1+1 lessons a week) (mark: 1,3,5)
Module Aims	Introduce the structure and working of common machines in dairy, meat and poultry processing
Module Subject	<p>Dairy: Milk transporting vehicle, Storage of milk, machines of general treatment of milk, special machines of cheese making, milk powder, processed cheese, etc.;</p> <p>Meat: Introduction of advanced equipment related to the technology. Transport machinery and equipment. Cutting lines and elements, special cutting equipment. Equipment related to further processing technology. Bone making, preparation machines, shredders, fillers, pickles, smokers, cookers, maturators, refrigerators.</p> <p>Poultry: Machines and equipment for collection transport. Cutting lines and elements, special cutting equipment. Machines for plucking water poultry. Machines for pen processing. Equipment related to further processing technology.</p>
Number of Credits	2

Course Code	
Module	
Title:	Food Chemistry
Teacher:	Balázs JÓJÁRT
Contact:	jojartb@mk.u-szeged.hu
Level	MSc (minimum 5 students)
Termin	fall semester (2 lessons a week) (mark: 1,2,3,4,5)
Module Aims	Discussion of the most important deterioration related to major food components. Functional properties of food components

Module Subject	General discussion of major food components Water activity Lipid oxidation processes in detail Caramelization in detail Maillard reaction in detail Enzymatic browning in detail Changes in proteins Acryl-amide formation in heated food stuff Functional properties of proteins, sugars, lipids in detail
Number of Credits	4

Course Code	
Module	
Title:	Instrumental Analysis
Teacher:	Balázs JÓJÁRT; Lukács NÉMETH
Contact:	jojartb@mk.u-szeged.hu ; nemethl@mk.u-szeged.hu
Level	MSc (minimum 5 students)
Termin	fall (1 lesson a week) (mark: 1,2,3,4,5)
Module Aims	Introduction to the commonly used instrumental techniques used in food analysis.
Module Subject	General introduction into food analysis: evaluation, precision, calibration Methods of spectroscopy: general introduction, interaction of light with matter UV-VIS spectroscopy, calibration methods Atom spectroscopy, ICP Potentiometry Polarimetry Conductometry, Mass spectrometry, NMR
Number of Credits	4

Course Code	
Module	
Title:	Dietetics (Nutrition science)
Teacher:	P. Balázs SZABÓ
Contact:	
Level	MSc, BSc (minimum 5 students)
Termin	spring semester (2 lessons a week) (mark: 1,3,5)
Module Aims	The goal is to learn the basics of nutrition.
Module Subject	Students will learn about the important micro and macro nutrients, their importance. In connection with this, they learn about the effects of deficiency or over intake and their prevention (and the possible treatment in a natural way). Energy and nutrient requirements. Physiological and biochemical processes in the body. Nutritional recommendations for a healthy adult population. Work-meal, water-physiological effect.
Number of Credits	2

Course Code	
Module	
Title:	Food Technology III.
Teacher:	P. Balázs SZABÓ
Contact:	
Level	MSc (minimum 5 students)
Termin	spring semester (2 lessons a week) (mark: 1,2,3,4,5)
Module Aims	The aim of this course is to learn different food technology

Module Subject	Beer technology, production of beer. Liquor technology, wine industry. Vegetable Oil Technology. Raw material. Sugar industry Canning and Refrigeration Technologies
Number of Credits	5

Course Code	
Module	
Title:	Food Machinery III.
Teacher:	P. Balázs SZABÓ
Contact:	
Level	MSc (minimum 5 students)
Termin	fall or spring semester (2 lessons a week) (mark: 1,2,3,4,5)

Module Aims The aim of this course is to examine different food technology

Module Subject	Beer technology machines, production of beer. Liquor technology machines, wine industry. Vegetable Oil Technology machines. Raw material. Sugar industry Canning and Refrigeration Technologies and machines
Number of Credits	2

Course Code	
Module	
Title:	Food Innovation
Teacher:	Ernő GYIMES
Contact:	
Level	MSc. (minimum 5 students)
Termin	spring semester (2 lessons a week) (mark: 1,3,5)

Module Aims

Module Subject	The course introduces the basics of food industry innovation. It reviews the concept and history of innovation. It introduces the most important innovation models (technology push, demand pull, backfeed, etc.). It describes the different sources of innovation and the measurement of innovation. It deals specifically with the characteristics of closed and open innovation and their comparison.
Number of Credits	4

Course Code	
Module	
Title:	Food Plant Design
Teacher:	Ernő GYIMES
Contact:	
Level	MSc, BSc (minimum 5 students)
Termin	fall semester (2 lessons a week) (mark: 1,3,5)

Module Aims

Module Subject	The course covers some of the most important areas for designing and setting up food plant. General requirements for food processing plants, practical application of the Hungarian and European Food Law. Explains the theoretical and practical aspects of production conditions. It shows the locations and connections of technology and engineering. He knows the layout of technological machines, the calculation of capacity and the calculation of the resource requirement. It affects the environmental aspects of plant installation.
Number of Credits	4

Course Code	
Module	
Title:	Food Packaging
Teacher:	Ernő GYIMES
Contact:	
Level	MSc (minimum 5 students)
Termin	fall semester (2 lessons a week) (mark: 1,3,5)
Module Aims	
Module Subject	<p>Preservation of foods. Food ruin (rancidity, browning, bacterial and fungi problems). Functions of food packaging. Packaging as a marketing tool. Demands and requirements (by law, consumer demands, logistics tasks). Labelling (text, bar codes, QR) Packaging materials and its behaviour: Glass packaging. Paper packaging. Plastic packaging. Metal packaging. Textile packaging. Biodegradable materials. Bottle and jar packaging lines for liquid foods. Pouch packaging machine for solid and viscous liquid foods. Powder and granulated foods packaging. Solid, semi liquid and liquid foods in cans. Edible packaging as an emerging technology</p>
Number of Credits	4

Course Code	
Module	
Title:	Food Product Development
Teacher:	Ernő GYIMES
Contact:	
Level	MSc (minimum 5 students)
Termin	fall semester (2 lessons a week) (mark: 1,3,5)
Module Aims	
Module Subject	<p>The aim of the course is to present the needs and economic background of product development. The following concepts are repeated: innovation, innovation models, innovation strategy. The relationship between innovation and marketing will be reviewed in detail. The basics of product development and innovation in the food industry will be introduced.</p> <p>The following niche market products are presented in more detail:</p> <ul style="list-style-type: none"> • Comfort products and their evolution from the 70s to the present • Functional foods • Nutrition Trends and Product Serving. • Lifestyle products, sports foods • Forever consumer - Antiaging products • Personal Foods
Number of Credits	4

Course Code	
Module	
Title:	Nutrition and Dietetics in Biosystems

Teacher:	Viktoria SZÚTS
Contact:	szutsv@mk.u-szeged.hu
Level	BSc (minimum 5 students)
Termin	fall or spring semester (2 lessons a week) (mark: 1,3,5)
Module Aims	The purpose is to get information about quality and quantity of foods and feeds. The aim is to know how the association of food metabolism and benefit at both cellular and organic level contributing for state of health. Healthy nourishment in daily life of children, adults and sports too.
Module Subject	The topic of sciences: Nutrition is a key to health: what you eat and why? Tools for diet design. The human body: a nutrition perspective – from genetics to anatomy and physiology of digestion, storage and excretory system. Composition and function of meat, flour, cereals, milk and vegetables. Degradation of vitamins in different foodstuffs during processing and storage. Changes of proteins in row foods plants, fruits and vegetables. Changes of lipids are different in foods. Why the Mediterranean meal is the healthy food? One prominent theme is nutrition research today is individuality: each person responds individually to nutrients and that something I continually point out in this lectures.
Number of Credits	4

Course Code	
Module	
Title:	Ion Channels of Living System and Channelopathies in Biosystem
Teacher:	Viktoria SZÚTS
Contact:	szutsv@mk.u-szeged.hu
Level	BSc (minimum 5 students)
Termin	fall or spring semester (2 lessons a week) (mark: 1,3,5)
Module Aims	The aim is to give an overview of the structure-function relations of sodium, calcium, potassium and chloride ion channels in plants and animal cells.
Module Subject	The topic of sciences: Ionic currents through specific ion channels are responsible for the electrical activity and thereby the normal mechanical function of all type of cells and strongly influence the utilization of food and feeds. Ion channel structure and function is compared between plants and animals. Sodium ion channels association and calcium ion channels: similarity and differences. Potassium ion channels have different structure in plants and animals with same function: diversity in function and contributes to quality of foods. Alteration of ion channel can modify the function: inheritance of diseases of sodium, calcium and potassium channels; channelopathy in plants and animals. Effects of toxins are led to change the physiological function of channels (i.e. fungal secondary metabolites). Environmental stress factors can modify the function of channels. Mutation effects of inheritance diseases.
Number of Credits	4

Course Code	
Module	
Title:	Remediation of destroyed ecological system with microbioms and plants
Teacher:	Viktória SZÚTS
Contact:	szutsvik@hotmail.com
Level	BSc, MSc (minimum 5 students)
Termin	fall or spring semester (2 lessons a week) (mark: 1,3,5)
Module Aims	The purpose is to get information about injured ecosystem and restored the normal living fauna and flora with new and traditional technology. The aim is to estimate the destroyed ecological and technological background and lay out of new program for remediate the area. One prominent theme is to continually point out new possibilities with bacteria's and hyper-accumulator plants in living machines.
Module Subject	The topic of sciences: Phytoremediation. The protection mechanisms in plants (genetic possibilities). Inorganic components (Material system: chemical bonds and reactions, environmentally inorganic substances). Mechanism of accumulation of metal ions (genetic possibilities). Damage and restoration of chelating processes. The aromatic phytoremediation. Phytovolatilization. Microorganisms. Living machines. Reduction of radionuclide contamination. Laboratory visit-online. Interactions in the atmosphere. Nitrogen, carbon and water cycle, role of

	microorganisms. Interactions in the atmosphere (Pollution and restoration issues, photophysical and photochemical processes, photodissociation processes in the troposphere. Investment and profit questions of remediation and economy. Individual reports and examinations.
Number of Credits	4

Course Code	
Module	
Title:	Pandemics and Food Safety
Teacher:	Diána BÁNÁTI
Contact:	banati@mk.u-szeged.hu
Level	MSc (minimum 5 students)
Termin	spring or fall semester (2 lessons a week) (mark: 1,3,5)

Module Aims	Aim of the course is to get acquainted with the food safety aspects of pandemics, the role of food in the transmission of epidemic agents.
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Module Subject	<p>Students will learn about the major zoonotic diseases caused by viruses (including coronaviruses, such as SARS-CoV, MERS-CoV, SARS-CoV-2). They will learn about the diseases they cause in animals and humans (incl. the so-called avian flu, swine flu, with special respect to COVID-19).</p> <p>In addition to general human health information, major food safety aspects of pandemics will be discussed. Participants will learn about the possible role of foodstuffs and packaging in the spread of coronaviruses, and will analyse food safety risks arising at each part of the food chain, including production, processing and the HoReCa sector. The role of processing in the elimination of those viruses will be discussed in more detail. Special problems related to consumers and households will be discussed, too.</p> <p>Up-to-date information provided by the major human health and food safety authorities, such as WHO, ECDC, EFSA, US FDA, USDA, CDC, whether SARS-CoV-2 or any other emerging viruses could be transmitted via foods and packaging will be shared. Food safety recommendations of those organisations will be analysed, too.</p>
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Number of Credits	4
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Course Code	
Module	
Title:	Kinematics and kinetics
Teacher:	István BÍRÓ
Contact:	biro-i@mk.u-szeged.hu
Level	BSc (minimum 5 students)
Termin	spring semester (2 lessons a week) (mark: 1,3,5)

Module Aims	<p>For students the main aims of the education of this module:</p> <p>Kinematic and kinetic investigation of moving mass points, rigid bodies and structures of rigid bodies including planar closed moving kinematical chains.</p> <p>Students will be able to compare the expected motion state with motion state realized by the investigated mechanism (moving structure).</p>
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Module Subject	<p>Kinematics of mass point. Position, velocity, acceleration. Motion equations and diagrams. Kinematical investigation of translational motion of mass points. Harmonic oscillation. Circular motion. General plane and spatial motion.</p> <p>Kinematics of rigid bodies. The motion state of rigid body. Elemental motion components. Description of planar motion of rigid bodies. Velocity and acceleration state of planar moving rigid bodies. Kinematics of relative motion of mass points and rigid bodies.</p> <p>Degrees of freedom of mechanisms, constructions, classification. Kinematical investigations of planar four-bar moreover centric and eccentric slider crank mechanisms. Kinematical investigation of cam-drive mechanisms. Kinematical analysis of complex closed planar mechanisms containing more revolute and prismatic joints.</p> <p>Kinetics of mass points. Motion equations of mass points. Impulse, angular momentum, work, energy, power, efficiency. Constrained motion. Kinetics of relative motion. Vibration of mass points. Free vibration, damped free vibration, excited-damped vibration.</p> <p>Kinetics of particle systems. Collision of mass points and rigid bodies. Classification of different collisions. Elastic</p>
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	impact, inelastic collision, real collision. Kinetics of rigid bodies. Inertial moment of rigid bodies. The rotation of rigid bodies. Planar motion of rigid bodies. Rotational oscillating motion.
Number of Credits	4

Course Code	
Module	
Title:	Modeling and Programming in Measurement
Teacher:	János SIMON, József SÁROSI
Contact:	sarosi@mk.u-szeged.hu
Level	BSc (minimum 5 students)
Termin	fall semester (0+2 lessons a week) (mark: 1,3,5)
Module Aims	Aim of the course is to introduce the modeling and programming in LabVIEW and Scilab environments with some practical aspects of measurement.
Module Subject	Introduction to measurement and data acquisition. Introduction to the LabVIEW Platform. Simple averaging and temperature conversion in LabVIEW. Acquisition and storage of measured data in LabVIEW without hardware. Configuring and testing DAQ devices. Acquire and output real-world signals, analyze data for meaningful information; develop embedded or autonomous systems; and share results using displays, reports. Acquisition and storage of measured data in LabVIEW with DAQ devices. Introduction to the Scilab. The Console & Editor. Matrices, functions & operators. Solving differential equations related to measurement in Scilab Xcos. Graphics & plotting.
Number of Credits	4

Course Code	
Module	
Title:	Engine and Vehicle Systems
Teacher:	Ferenc FARKAS
Contact:	farkasf@mk.u-szeged.hu
Level	BSc (minimum 5 students)
Termin	fall semester (2 lessons a week) (mark: 1,3,5)
Module Aims	For students the main goals of the education of this module: - to study different engine and vehicle systems - to be able to compare this systems - to know reasonable choosing the perfect solutions
Module Subject	Engine systems - Otto and Diesel engines - Four and two stroke cycle engines - Cycles of internal combustion engines - Losses, efficiencies and main characteristic curves - Process of mixture forming - Electronic injection systems - Supercharging of engines - Cooling and lubrication of engines Vehicle systems - Function of the power transmission systems - General construction of the master clutches, gear boxes, differential gears and the cardan drives - Carriage constructions and steering of vehicles - Brake systems of vehicles
Number of Credits	4

Course Code	
Module	
Title:	Automobile Industry
Teacher:	Ferenc FARKAS
Contact:	farkasf@mk.u-szeged.hu
Level	BSc (minimum 5 students)
Termin	fall or spring semester (2 lessons a week) (mark: 1,3,5)
Module Aims	Aim of the course is to introduce the automobile industry, management, design, safety, basic definitions and terminology. Some practical aspects are also part of the subject.
Module Subject	Introduction to the car: Factors involved in buying a car; Types of car; Car sales The exterior: Exterior car parts; Car production; A quality problem; 8D report The interior: Interior car parts; The instrument panel; A delivery problem; A car configuration Under the bonnet: The engine; A technical support hotline; An international car show Performance and technical specifications: Launching a new model; A road test; Materials and their properties; A meeting role-play Safety: A magazine article; Active and passive safety features; Choosing safety features; Car recalls Design: Describing car design; The design process; Constraints; Expanding the product range Future trends: The car of the future; Environmental awareness; Making a presentation; Fuel cells
Number of Credits	4

Course Code	
Module	
Title:	Computer Aided Design and Modeling
Teacher:	Sandor Jozsef FORRAI
Contact:	forrai.sandor.jozsef@gmail.com
Level	BSc (minimum 5 students)
Termin	fall semester (0+2 lessons a week) (mark: 1,2,3,4,5)
Module Aims	Improving the student's knowledge in the field of computer-aided design. Demonstrate the management of parametric solid state design software using Autodesk Inventor. During the semester, students create an independent assignment, which is presented in the software or in a presentation at the end of the semester.
Module Subject	The basics of 3D modeling in Inventor Solid modeling Assembly modeling Modeling of moving parts in Inventor Frame modeling Exploded view and animation
Number of Credits	4

Course Code	
Module	
Title:	Surface physics
Teacher:	Miklós FÜLE
Contact:	mfule@mk.u-szeged.hu
Level	MSc (minimum 5 students)
Termin	autumn semester (2 lessons a week) (mark: 1,2,3,4,5)
Module Aims	The goal of the course is to getting know the importance, theory and application of solid surfaces.
Module Subject	Definition of surface and physical description of it. Importance of the surface in material science. Atomic structure of the pure surfaces. Discussion of the surface electron structure and derivation it from the bulk crystal properties. Adsorption of contamination on surface. Defect of the surface crystal structure. Theoretical model of

	adsorption, desorption and diffusion as they effect on surface properties. Building of thin layer and atomic structures. Basis of vacuum technology. Surface examination method: diffraction (LEED, RHEED, GIXRD, TED, PED, AED), electron spectroscopy, microscopy (SEM, TEM, AFM, STM, optical microscopy).
Number of Credits	4

Course Code	
Module	
Title:	Differential Equations
Teacher:	László CSIZMADIA
Contact:	lcsizmadia@mk.u-szeged.hu
Level	BSC (at least 4th semester), MSC (1st semester)
Termin	spring (4 lessons a week: 2 lessons, 2 practices)
Module Aims	Introducing to basic concepts and basic proceedings of differential equations with loads of examples.
Module Subject	On the existence and uniqueness of solution of initial value problem; basic numeric methods (e.g. explicit, implicit Euler's method). Systems of ordinary differential equations. Mathematical model of some mechanical systems: models by the equation of $mx''+kx'+hx=F$ ($m, k, h>0, F: \mathbb{R} \rightarrow \mathbb{R}, x=x(t): (a,b) \rightarrow \mathbb{R}$). Basic concepts of Stability Theory of autonom systems: definitions by Ljapunov, phase space and stability property of the equilibrium. On the dynamical systems: maps, cobweb diagrams, properties of the fixed points, bifurcations.
Number of Credits	4

Course Code	
Module	
Title:	Industrial Heat-transport
Teacher:	Erika VARGA-SIMON
Contact:	siera@mk.u-szeged.hu
Level	BSc (minimum 5 students)
Termin	spring semester (2 lessons a week) (mark: 1,3,5)
Module Aims	Aim of the course is to introduce the background of the heating and cooling instruments; give elemental methods to calculate the size of a heat exchanger. Show some type of these instruments in industrial technologies.
Module Subject	<p>Mathematical and process background:</p> <ul style="list-style-type: none"> • Convective heat transfer • Heat conduction • Role of Nusselt numbers • Role of Reynolds numbers • Forced convection, roles of pumps • Calculate the size of the heating surface <p>Main types of heat exchangers</p> <ul style="list-style-type: none"> • Heat exchangers for fluidics • Heat exchangers for gases <p>Industrial areas using heat exchangers:</p> <ul style="list-style-type: none"> • Food-industry (pasteurization, sterilization, cooling, drying) • Air condition, heat pumps systems
Number of Credits	4

Course Code	
Module	
Title:	Data and information visualization

Teacher:	György HAMPEL
Contact:	hampel@mk.u-szeged.hu
Level	BSc (minimum 5 students, maximum 20 students)
Termin	fall or spring semester (2 lessons a week) (mark: 1,3,5)
Module Aims	The aim of the course is to give an overview of human and computer aided information processing and visualization.
Module Subject	Human information processing. Statistical data and information visualization using computer applications. The types of data and information. The use of different chart types. Representation of relationships between data. Infographics.
Number of Credits	4

Course Code	
Module	
Title:	Organization and Logistics of Tourism
Teacher:	József GÁL
Contact:	galj@mk.u-szeged.hu
Level	BSc (minimum 5 students)
Termin	fall or spring semester (2 lessons a week) (mark: 1,3,5)
Module Aims	Aim of the course is to introduce European tourism. We focus on Central and Eastern European part of the continent. To know some rules and financial aspects. Students plan a journey and make a tourist guide for travel agencies and a short film.
Module Subject	Europe and tourism, The history of tourism in Europe, The history of modern tourism in Europe, Tourist regions in Europe, The European Union, Tourism policy in the European Union, Regional policy and tourism in the European Union, Tourism and euro, Transportation in Europe and its impact on tourism, Environmental and social concerns in European tourism, Business tourism in Europe, Marketing Europe as a tourist destination, Tourism in Central and Eastern Europe, New trends in the European tourist industry
Number of Credits	4

Course Code	
Module	
Title:	Elements of Marketing
Teacher:	Edina LENDVAI
Contact:	lendvai@mk.u-szeged.hu
Level	BSc (minimum 5 students)
Termin	fall semester (2 lessons a week) (mark: 1,3,5)
Module Aims	Aim of the course is to learn more about marketing and advertising. Students have exercises how to use marketing tools in practice. Marketing and engineering.
Module Subject	Introduction to marketing and advertising: Jobs and responsibilities, Corporate identity, logos, Branding Finding the customer: Market research, Customer profiles, Data collection, A telephone survey Planning a marketing strategy: The marketing plan, The four Ps, Pricing and positioning strategies Creating ads: The AIDA model for advertising, Working with an ad agency, Advertising channels, Rate sheets Marketing tools: Distribution channels, Types of discount, Types of retailer, Telemarketing, Direct marketing Presenting your public face: Public relations, Websites as a marketing tool, Sponsoring, Effective press releases Marketing through trade fairs: Giveaways, Organizing events, Attending a trade fair
Number of Credits	4

Course Code	
Module	
Title:	Business & Management

Teacher:	József GÁL
Contact:	galj@mk.u-szeged.hu
Level	BSc (minimum 5 students)
Termin	fall or spring semester (2 lessons a week) (mark: 1,3,5)
Module Aims	Aim of the course is to introduce terminology and most important parts of business & management.
Module Subject	Industrial plant, enterprise, enterpriser and manager, subject of business, administration and scientific administration, selection of profession, enterprising and management, market conditions and production factors, production costs, plant sizes, plant location, juridical organization of plants, internal organization of plants, order, supervising and functional authority, centralization and delegation of authority, principles of organization, financial policies and sources.
Number of Credits	4

Course Code	
Module	
Title:	Customer Care
Teacher:	József GÁL
Contact:	galj@mk.u-szeged.hu
Level	BSc (minimum 5 students)
Termin	fall or spring semester (2 lessons a week) (mark: 1,3,5)
Module Aims	Aim of the course is to introduce in flight and on board services. Students learn about airport technology, passenger safety, ground movements and services during flight. Some practical aspects are also part of the subject.
Module Subject	Introduction to customer care: Customer care success, Customer care business and jobs, Surprising facts about customer care Face to face with customers: Body language, A company visit, Meeting do's and don'ts, At a trade fair, The invisible customer Dealing with customers on the phone: General telephoning, The 'customer care' phone call, What the customers really hear Call center success: Taking an order, Hotline (Troubleshooting), Customer-centered call centers Delivering customer care through writing: Effective letters and emails, Format and informal writing styles, The five Cs of customer care writing, A case study Dealing with problems and complaints: Complaint strategies and policies, The letter of apology, Explaining company policy, Some opinions about complaints and apologies
Number of Credits	4

Course Code	
Module	
Title:	Sales & Purchasing
Teacher:	József GÁL
Contact:	galj@mk.u-szeged.hu
Level	BSc (minimum 5 students)
Termin	fall or spring semester (2 lessons a week) (mark: 1,3,5)
Module Aims	Aim of the course is to introduce in sales and purchasing in engineering. Students learn about how to buy and sell, manage trade in engineering. Some practical aspects are also part of the subject.
Module Subject	Job and responsibilities: Job titles and tasks, A sales meeting, A sales meeting, A requisition New contacts: At a trade fair, Relationship building, Fellow-up emails Offers: A sales pitch, The AIDA approach to sales, A request for proposal, An offer letter Negotiations: Tips for successful negotiations, A company visit, Negotiating styles, Win-win negotiations Orders: Telephone orders, An online order, A change to an order, Numbers and figures, Contract term and phrases Customer care: Dealing with problems over the telephone and in writing, An online complaint form
Number of Credits	4

Credits	
Course Code	
Module	
Title:	Economics
Teacher:	József GÁL
Contact:	galj@mk.u-szeged.hu
Level	BSc (minimum 5 students)
Termin	fall or spring semester (2 lessons a week) (mark: 1,3,5)
Module Aims	Aim of the course is to introduce the logistics, basic definitions and terminology. Some practical aspects are also part of the subject.
Module Subject	The General Theory of the Goods. Economy and Economic Goods. The Theory of Value. The Theory of Exchange. 4 Principles of Economics. Use Value and Exchange Value. The Theory of the Commodity. The Theory of Money. Macroeconomics. Case studies and presentations.
Number of Credits	4

Course Code	
Module	
Title:	Logistics
Teacher:	József GÁL
Contact:	galj@mk.u-szeged.hu
Level	BSc (minimum 5 students)
Termin	fall or spring semester (2 lessons a week) (mark: 1,3,5)
Module Aims	Aim of the course is to introduce the logistics, basic definitions and terminology. Some practical aspects are also part of the subject.
Module Subject	Introduction to logistics: Setting the scene; Job in logistics; Regular activities Logistics services: Logistics acronyms; Product ranges; 3PL providers; Value-added services Inventory management and procurement: Inventory management; Continuous replenishment; Job advertisements Modes of transport: Transport and handling equipment; Container types, Types of goods Planning and arranging transport: Transport options, Measurements, Quotations Shipping goods: Marking, Loading, Advice of shipment, Shipping instructions Warehousing and storage: Handling equipment, Warehouse areas, Warehousing today Documentation and finance: Documents in foreign trade, Import instructions, Payment methods
Number of Credits	4

Course Code	
Module	
Title:	Business planning
Teacher:	Árpád BENKŐ-KISS
Contact:	benko-ka@mk.u-szeged.hu
Level	BSc (minimum 5 students)
Termin	fall or spring semester (2 lessons a week) (mark: 1,3,5)
Module Aims	Aim of the course is to introduce most frequent methods and parts of Business planning, and financial calculations.
Module Subject	Basics of Accounting, The Balance sheet and Income statement Securities, Financial calculations, Credits, and paybacks, Turnover NPV, IRR, Marketing, Financial ratios, Brake even analysis, Financial calculations- interest and compound interest, Geometric series in financial calculations Depreciation, Risk analysis, Cost Benefit Analysis CBA)

Number of Credits	4
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Course Code	
Module	
Title:	Human Resource Management
Teacher:	Sándor NAGY
Contact:	nagys@mk.u-szeged.hu
Level	BSc (minimum 5 students)
Termin	fall or spring semester (2 lessons a week) (mark: 1,3,5)
Module Aims	Aim of the course is to introduce the human resource management. Some practical aspects are also part of the Course.
Module Subject	What is HRM? Basics of the HRM. Understanding the logic of the management of the human resources. Challenges and new aspects of the topic. E.g. focusing on engineering aspects, managing the elderly workforce at the BMW car manufacturer, creativity management and its connections to engineering dimensions, complexity management affecting the HRM.
Number of Credits	4

Course Code	
Module	
Title:	Startup-ecosystems, Competitiveness and Sustainability
Teacher:	Sándor NAGY
Contact:	nagys@mk.u-szeged.hu
Level	BSc (minimum 5 students)
Termin	fall or spring semester (2 lessons a week) (mark: 1,3,5)
Module Aims	Aim of the course is to introduce the logic of the competitiveness and the extended interpretation of sustainability in the field of competitive sector.
Module Subject	Understanding the definitional evolution of the notion of competitiveness and sustainability. The content of the value creation-based competitiveness regarding the competitive sector Startup-ecosystems, innovation attitudes of startup companies "Engineering the value creation" 7 pillars of the sustainability Strategic aspects of the competitiveness (Blue Ocean Strategy, sustainable competitiveness and how to harmonize the competitiveness and sustainability) Innovation – sustainability – competitiveness Case Studies
Number of Credits	4

Course Code	
Module	
Title:	Strategic Management
Teacher:	Árpád BENKŐ-KISS
Contact:	benko-ka@mk.u-szeged.hu
Level	BSc (minimum 5 students)
Termin	fall or spring semester (2 lessons a week) (mark: 1,3,5)
Module Aims	Aim of the course is to introduce the strategy management. Some practical aspects are also part of the subject.
Module Subject	Methodology of strategic planning. The environment of strategy (collecting facts, etc). Strategy formulation (formulation of the target image, selection of target groups, etc.) Strategy implementation.

	Strategy evaluation and control.
Number of Credits	4

Course Code	
Module	
Title:	Corporate Finance for Engineers
Teacher:	Brigitta ZSÓTÉR
Contact:	zsoterb@mk.u-szeged.hu
Level	BSc (minimum 5 students)
Termin	fall or spring semester (2 lessons a week) (mark: 1,3,5)

Module Aims	Aim of the course is to introduce the finance, basic definitions and indicators. Some practical aspects are also part of the subject.
Module Subject	Introduction to corporate finance: The role of the financial manager. Separation of ownership and management. Financial markets. Present Value. Net Present Value. NPV Rule. ROR Rule. Opportunity Cost of Capital. Managers and the Interests of Shareholders. Valuing Long-Lived Assets. PV Calculation. Short Cuts. Compound Interest. Nominal and Real Rates of Interest (inflation). Example: Present Values and Bonds. How Common Stocks are Traded? How to Value Common Stock? Capitalization Rates. Stock Prices and EPS. Discounted Cash Flows and the Value of a Business. Why Net Present Value Leads to Better Investment Decisions than Other Criteria?

Number of Credits	4
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Course Code	
Module	
Title:	IT today
Teacher:	György HAMPEL
Contact:	hampel@mk.u-szeged.hu
Level	BSc (minimum 5 students, maximum 20 students)
Termin	fall or spring semester (2 lessons a week) (mark: 1,3,5)

Module Aims	The aim of the course is to give an overview of the practical use of today's information technology.
Module Subject	The concept of data and information. Numeral systems, the representation of numbers, character encoding, logical operations and gates. Types and characteristics of computer hardware, software and networks. The different types of operating systems; their main features and services. Design and implementation of algorithms. Types and capabilities of information systems and office applications.

Number of Credits	4
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Course Code	
Module	
Title:	Database management
Teacher:	György HAMPEL
Contact:	hampel@mk.u-szeged.hu
Level	BSc (minimum 5 students, maximum 20 students)
Termin	fall or spring semester (2 lessons a week) (mark: 1,3,5)

Module Aims	The aim of the course is to give an overview of data models and the MySQL open source relational database management system
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Module Subject	The concept of data and database. Modelling databases: the entity-relationship model and the relational data model. Normalization. Relational algebra. The Structured Query Language (SQL): syntax, data types, functions. Managing databases with MySQL open source relational database management system: creating models and converting them to database tables; creating, modifying and deleting databases and tables; creating relationships between tables; data input and output; creating queries. Database security.
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Number of Credits	4
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Course Code	
Module	
Title:	Introduction to Public Finances
Teacher:	Sándor NAGY
Contact:	nagys@mk.u-szeged.hu
Level	BSc (minimum 5 students)
Termin	fall or spring semester (2 lessons a week) (mark: 1,3,5)
Module Aims	Aim of the course is to introduce the logic of public finance management, the public decisions, the components and the contribution of the public finance system to sustainability and competitiveness.
Module Subject	Understanding the definitional evolution of the notion of public finances and the public finance management, the competitiveness and sustainability as well. The components of public finance system The functions of the public finance system Public decisions How to design and implement the budget The role of control mechanisms Contribution to the state level competitiveness and sustainable development Case Studies
Number of Credits	4

Course Code	
Module	
Title:	Cross-border Cooperation
Teacher:	Sándor NAGY
Contact:	nagys@mk.u-szeged.hu
Level	BSc (minimum 5 students)
Termin	fall or spring semester (2 lessons a week) (mark: 1,3,5)
Module Aims	The course introduces the basic knowledge about border theory and applied regional policy. The focus will be mainly put on the regional policy of the European Union, its programs and their effects on the border zones in Europe. In addition, case studies will be demonstrated.
Module Subject	The European space, Macrostructures in Western and Eastern Europe, Definitions of border, Border theories, Border regions in Europe and in Hungary, Cross-border agglomerations, Touristic aspects of borders
Number of Credits	4

Course Code	
Module	
Title:	Food Economy and Marketing
Teacher:	Edina LENDVAI
Contact:	lendvai@mk.u-szeged.hu
Level	MSc, BSc (minimum 5 students)
Termin	fall semester (2 lessons a week) (mark: 1,3,5)
Module Aims	To know the most important elements of the marketing. To able to plan the marketing strategy, with the elements of the marketing mix.
Module Subject	The definition-change of the marketing. The history of the marketing. The segmentation, targeting and positioning. The marketing research. The marketing mix. 4 P, 7 P, 4 C
Number of Credits	4

Credits	
Course Code	
Module	
Title:	Food Process Organization
Teacher:	Edina LENDVAI
Contact:	lendvai@mk.u-szeged.hu
Level	MSc, BSc (minimum 5 students)
Termin	spring semester (2 lessons a week) (mark: 1,3,5)
Module Aims	To know the basic steps of the food process organization, the elements of the lean management, and the special characteristic of the food industry. To able to plan a correct process in food industry
Module Subject	The food, novel food in EU. The main special characters of the food industry – input side, output side. The trends of consumption. The most important knowledge about the NACE in EU and in Hungary (TEÁOR). The history of the food organization-planning, Grant, Poreto, Taylor and others. The elements of the lean. 5 S, 8 wastes.
Number of Credits	4

Course Code	
Module	
Title:	Business Management and Communication
Teacher:	Brigitta ZSÓTÉR
Contact:	zsoterb@mk.u-szeged.hu
Level	MSc, BSc (minimum 5 students)
Termin	fall or spring semester (2 lessons a week) (mark: 1,3,5)
Module Aims	Aim of the course is to introduce the business management and the communication. Some practical aspects are also part of the subject.
Module Subject	Introduction to business management. What is the corporate? The levels of the business ethics. Stakeholders. The definition of communication. The channels and kinds of the communication. Verbal communication. Not verbal communication. Presentation. Business talk. Negotiation techniques.
Number of Credits	4

Course Code	
Module	
Title:	Project management and investment
Teacher:	Árpád BENKŐ-KISS
Contact:	benko_ka@mk.u-szeged.hu , arpadbenko@gmail.com
Level	BSc (minimum 5 students)
Termin	spring semester (2 lessons a week) (mark: 1,3,5)
Module Aims	Aim of the course is to develop projects including the planning process, including the the financial analysis, calculations and risk analysis.
Module Subject	<ul style="list-style-type: none"> • Project development planning tools and methods. • Project development process, prepare and decision making. • Project management members and roles.

	<ul style="list-style-type: none"> • Financial background and calculations (investment, operation, turnover). • Sensitivity profitability and efficiency. • Communication plan and stakeholders • Case studies, based on real projects
Number of Credits	4

Course Code	
Module	
Title:	Mastering Word
Teacher:	György HAMPEL
Contact:	hampel@mk.u-szeged.hu
Level	BSc (minimum 5 students, maximum 20 students)
Termin	fall or spring semester (2 lessons a week) (mark: 1,3,5)
Module Aims	Microsoft Word is a very popular word processing software although most of its users do not use several of the functions that are available to simplify text editing. The aim of the course is to show the methods that can be used to make word processing more effective especially when working with large documents.
Module Subject	Getting rid of bad habits when typing and formatting text and introducing methods to use instead. Modifying the GUI. Making macros. Organizing the structure of the document. Automatic numbering of sections, diagrams, tables and equations. Using, modifying and creating styles and templates. Creating forms. Creating circulars. Creating bookmarks, indexes, table of contents, references and bibliography. Merging documents.
Number of Credits	4

Course Code	
Module	
Title:	Data analysis with Excel
Teacher:	György HAMPEL
Contact:	hampel@mk.u-szeged.hu
Level	BSc, MSc (minimum 5 students, maximum 20 students)
Termin	fall or spring semester (2 lessons a week) (mark: 1,3,5)
Module Aims	The use of Microsoft Excel is widespread in the industry. The aim of the course is to give an overview of the powerful data analysis tools of the program which can be used in most businesses even in their day-to-day functioning.
Module Subject	Importing and exporting using various formats. Organizing data into tables. Using database functions. Descriptive statistical methods and mathematical statistics in Excel. Creating interactive charts. Creating and using dashboards. Using free add-ons to analyse data.
Number of Credits	4