Title of the study course	**Biochemistry**				
Type of the study course	Compulsory			**Recommended study year / semester**	1/WS
Semester hours	24 lectures, 24 seminars	**hours**	48	**ECTS**	5
Type of students´ assessment	credit, exam			**Study form**	Lectures, laboratory practices, seminars
Description of study assessment and further requests	Credit – written test (2x) + credit test (1x) Exam – exam test (1x) + oral exam				
Guarantor of study course	doc. Ing. Petr Kačer, Ph.D.				
Involvement of guarantor in teaching	Lectures, laboratory practices				
Lecturer	doc. Ing. Petr Kačer, Ph.D. (100 % lectures and seminars)				

Short content of lectures and seminars

Lectures (major topics):

- The chemical basis of life. Aqueous chemistry.
- Introduction into genes and proteins. Protein structure.
- Protein function. How enzyme work.
- Enzyme kinetics and inhibition. Lipids and membranes.
- Membrane transport and cellular signaling.
- Carbohydrates. Overview of metabolism and free energy.
- Glucose metabolism. Citric acid cycle.
- Oxidative phosphorylation. Photosynthesis.
- Lipid metabolism. Nitrogen metabolism.
- Regulation of mammalian fuel metabolism.
- DNA replication and repair.
- Transcription and RNA. Protein synthesis in the cell.

Laboratory practices/seminars:

- Overview of organic reactions. Reactions in biochemistry.
- Determination of isoelectric point by coagulation method.
- Proteins quantitation by Lowry reagent.
- Isolation of nucleoproteins from yeast.
- Carbohydrates by HPLC. Preparation of the biological materials.
- Quantitation of reducing sugars in the biological materials by Nelson.
- Vitamins as cofactor of enzyme. Quantification of L-ascorbate.
- Ascorbatoxidase activity in plants.
- Influence of pH and enzyme concentration on amylase activity.
- Influence of temperature on enzyme activity.
- Influence of substrate and enzyme concentration on enzyme activity.
- Regulation of enzymatic reaction with Cu and Cl ions.

Literature

PRATT, CH. W., CORNELY, K. Essential Biochemistry, 3e, Wiley 2013. ISBN - 978-1118083505.
TYMOCZKO, J. L., BERG J. M., STYER, L. Biochemistry: A Short Course, 3e, Freeman 2015. ISBN - 978-1464126130.
NELSON, D. N. Lehninger principles of biochemistry, W. H. Freeman, 7e, 2017, ISBN-13: 978-1464126116.
RODWELL et al. Harper's illustrated biochemistry, McGraw-Hill Education, 31e, 2018, ISBN-13: 978-1259837937.

Title of the study course	**Animal Biotechnology**				
Type of the study course	Compulsory			**Recommended study year / semester**	1/WS
Semester hours	16 lectures, 6 seminars, 2 fieldwork	**hours**	24	**ECTS**	3
Type of students´ assessment	credit, exam			**Study form**	Lectures, seminars, fieldwork
Description of study assessment and further requests	Credit – minimum 75% presence, presentations in PowerPoint on given topic related to subject Exam – written exam				
Guarantor of study course	José Luis Ros-Santaella, Ph.D.				
Involvement of guarantor in teaching	Lectures, seminars				
Lecturers	José Luis Ros-Santaella, Ph.D. (50% lectures + seminars); Eliana Pintus, Ph.D. (50% lectures + seminars)				
Short content of lectures and seminars					

Lectures:

- Introduction to biotechnology.
- Introduction to spermatology. Sperm collection methods.
- Sperm preservation and analyses.
- Oocyte collection and evaluation.
- Artificial insemination and in vitro fertilization.
- Principles of animal cloning.
- Transgenic animals and stem cells.
- Gut microbiome and nutritional biotechnology.

Seminars:

- Sperm analyses techniques: sperm concentration and morphology.
- Sperm analyses techniques: sperm membrane and acrosome integrity.
- Oocyte culture and evaluation.

Fieldwork:
Student's seminars and multimedia activities.

Literature

THIEMAN, J. T., PALLADINO, M. A. Introduction to Biotechnology. Pearson Education Limited, 2014. ISBN: 1-292-02761-4.
SINGH, B., MAL, G., GAUTAM, S. K., MUKESH, M. Advances in Animal Biotechnology. Springer International Publishing, 2019. ISBN 978-3-030-21308-4.
CHENOWETH, P. J., LORTON, S. P. Animal Andrology: Theories and Applications. CAB International, 2014. ISBN: 978-1-78064-316-8.

Title of the study course	**Crop Management Systems**				
Type of the study course	Compulsory			**Recommended study year / semester**	1/SS
Semester hours	24 lectures, 24 seminars	**hours**	48	**ECTS**	5
Type of students´ assessment	Credit, exam			**Study form**	Lectures, seminars
Description of study assessment and further requests	Credit – defense of seminar work Exam – written + oral exam				
Guarantor of study course	Ing. Kateřina Pazderů, Ph.D.				
Involvement of guarantor in teaching	Lectures, seminars				
Lecturer	Ing. Kateřina Pazderů, Ph.D. (100%)				

Short content of lectures and seminars

Lectures:

- General principles of field crops growing technologies.
- Information resources for farmers, use of SDO and the results of agricultural research in agronomic practices.
- Growing technologies and yield formation. Influencing of yield components.
- Cereals. Growing technology of winter wheat.
- Cereals. Growing technology spring barley and grain maize.
- Legumes. Growing technology of pea.
- Oil crops. Growing technology of winter rapeseed.
- Oil crops. Growing technology of poppy, soya and sunflower.
- Root and tuber crops. Growing technology of sugar beet.
- Root and tuber crops. Growing technology of potatoes.
- Student projects' presentations.
- Student projects' presentations.

Seminars:

- Seminary introduction. Field crops, demonstration of plants, their fruits, ears and seeds.
- Agrobiological control in crop production.
- Plants growth and development evaluation.
- Agrobiological control in practice. Field excursion.
- Cereals - evaluation of yield components, spike analyses. Calculation of theoretical yield.
- Legumes (pulses) - yield components evaluation.
- Oil crops - ideotype of oilseed rape stands, evaluation of the plants before overwintering.
- Winter oilseed rape - field excursion, nutrition state, stand density.
- Potatoes - yield components, quality evaluation of seed potatoes.
- Sugar beet - stand structure, yield influencing. Evaluation of harvest losses.
- Common project. Preparation of technological card.
- Common project. Preparation of technological card.

Literature

Lectures available in IS Moodle
RAMAN, S., 2006: Agricultural Sustainability: Principles and Prospects. Food Products Press. Binghamton, NY, 474 p.
PETR J. et al. (1991): Weather and Yield. Elsevier, Amsterdam, 288 p.
STRUIK, P. C. et al., 1993: Plant Production on the Threshold of a New Century. Kluwer Acad., The Netherlands, 501 p.
REDDY, K. R., HODGES, H. F. (eds.), 2000: Climate Change and Global Crop Productivity. CABI Publishing, UK, 472 p.

Title of the study course	**Soil and Plant Relationship**				
Type of the study course	Compulsory			**Recommended study year / semester**	1/SS
Semester hours	24 lectures, 24 seminars	**hours**	48	**ECTS**	5
Type of students´ assessment	credit, exam			**Study form**	Lectures, laboratory practices
Description of study assessment and further requests	Credit – defense of protocols from seminars, written test Exam – oral exam with time for written preparation				
Guarantor of study course	prof. Ing. Pavel Tlustoš, CSc.				
Involvement of guarantor in teaching	Lectures				
Lecturers	prof. Ing. Pavel Tlustoš, CSc. (90 % lectures), doc. Ing. Martin Kulhánek, Ph.D. (10 % lectures, 50 % seminars), Prof. Ing. Aleš Hanč, Ph.D. (50 % seminars)				

Short content of lectures and seminars

Lectures:

- Introduction to soil-plant and the environment mutual relationship.
- Plant composition, basic, major, and minor nutrients, their definition, and importance.
- Nutrients in solid, liquid, and gaseous soil phase, the equilibria, and interactions.
- Principles of element sorption in soils, sorption parameters, and limitations.
- Transport of nutrients through the membrane. Active and passive element uptake by plants.
- Importance of roots in the uptake. Rhizosphere and its role in nutrient uptake. Endo and ectomycorrhiza.
- Nutrient cycles in the environment, carbon cycle.
- Availability of nitrogen and phosphorus for plants, N and P assimilation, important compounds for the nutrition.
- Potassium, magnesium and calcium relationship in soil, cation exchange capacity, their uptake by plants.
- Micronutrients, their interactions in soils, availability for plants and plant uptake, their role in nutrition.
- Availability of potentially toxic elements for plants, their phytotoxicity and transport into food chain.
- Adverse effect of organic toxic elements for plants, and inhabitants, their mobility in the environment.

Seminars:

- Introduction, Safety instructions.
- The importance of soil tests, composition of extract solutions, limitations.
- Soil extraction. Determination of soil electroconductivity, exchangeable and water-soluble pH.
- Determination of available nutrients, extraction of soil samples by different extractants, mobile and labile pools.
- Determination of water soluble, and labile pools of P in soil, the evaluation.
- Determination of water soluble, mobile, and labile pools of K in soil, the evaluation.
- Determination of water soluble, mobile, and labile pools of Mg in soil, the evaluation.
- Cation exchange capacity – calculation, examples.
- The evaluation of soil analyses results, the estimation of soil fertility. Test.
- Decomposition procedures for plant analyses, wet and dry digestion.
- Determination of N in plant biomass.
- Determination of P and Mg in plant biomass, the evaluation of element content in plants.

Literature

ROBERTS K. (ed.) (2007): Handbook of plant science. Vol. 1 and 2, J. Wiley and Sons, Chichester, England 784 p.
MARSCHNER P. (ed.) (2012): Marschner`s mineral nutrition of higher plants. Academic Press, London, 651 p.
MENGEL K., KIRKBY E.A. (2015): Principles of plant nutrition. Bio-Green Books, New Delhi, 687 p.
www.moodle.czu.cz
HATFIELD J.L., FOLLETT R.F. (2008): Nitrogen in the environment. Academic Press, San Diego, 702.
WEEB G. P. (2019): NUTRITION – maintaining and improving health. Taylor and Francis, 646 s.
ADRIANO D.C. (2001). Trace elements in terrestrial environments. Springer-Verlag, New York, 866 s.
KABATA-PENDIAS A., MUKHERJEE A. B. (2007): Trace elements from soil to human. Springer-Verlag Berlin, Heidelberg, 550 s.

Title of the study course	**Food Chemistry**				
Type of the study course	Compulsory			**Recommended study year / semester**	1/SS
Semester hours	24 lectures, 36 seminars	**hours**	48	**ECTS**	6
Type of students´ assessment	Credit, exam			**Study form**	Lectures, seminars
Description of study assessment and further requests	Credit – written test (2x) + credit test (1x) Exam – exam test (1x) + oral exam				
Guarantor of study course	doc. Ing. Petr Kačer, Ph.D.				
Involvement of guarantor in teaching	Lectures, seminars				
Lecturer	doc. Ing. Petr Kačer, Ph.D. (100%)				

Short content of lectures and seminars

Lectures (major topics):

- Introduction to food chemistry. Amino acids, peptides and proteins. Reactions.
- Fats, oils and lipids. Homo-lipids, hetero-lipids, complex lipids. Reactions.
- Carbohydrates. Monosaccharides, oligosaccharides, polysaccharides. Reactions.
- Vitamins. Reactions.
- Minerals. Essential elements. Toxic elements. Radionuclides.
- Water. Interactions in foods. Dispersed systems. Water activity.
- Flavour-active compounds. Odour-active compounds. Taste-active compounds.
- Pigments and colourings. Natural and synthetic pigments.
- Antinutritional, toxic and other bioactive substances in foods.
- Food additives (colorants, antioxidants, texture modifiers).
- Food contaminants. Processing contaminants. Pesticides. Veterinary drugs. Persistent organohalogen contaminants.

Seminars (laboratory practices):

- Analysis of carbohydrates by HPLC.
- Quantitation of ash and crude fiber.
- Quantitation of hydrophilic vitamins.
- Quantitation of phenolics acids in agricultural crops.
- TLC separation of terpenes from spices.
- Analysis of pesticides by QUECHERS and LC-MS/MS.
- Analysis of aflatoxins in nuts and oilseeds.
- Factors influencing the outcome of Maillard reaction.
- Analysis of anthocyanins from fruit extracts by HPLC.
- Water activity and Karl-Fischer titration.
- Nitrogen content of foods.
- Analysis of acesulfame K in sweetened drinks.

Literature

VELISEK, J. The Chemistry of Food. Wiley Blackwell, 2016. ISBN – 978-1118383841.
DAMODARAN S., PARKIN, K. L., FENNEMA O. R.: Fennema's Food Chemistry, 4th Edition, CRC Press, 2007.
BELITZ H. D., GROSCH W., SCHIEBERLE P.: Food Chemistry, 4th Edition, Springer, 2009.

Title of the study course	**Advanced Technology in Food Processing**				
Type of the study course	Compulsory			**Recommended study year / semester**	1/LS
Semester hours	24 lectures, 24 seminars	**hours**	48	**ECTS**	5
Type of students´ assessment	credit, exam			**Study form**	Lectures, seminars
Description of study assessment and further requests	Credit – based on the active participance on the seminars Exam – oral exam				
Guarantor of study course	Doc. Ing. Jaroslav Havlík, Ph.D.				
Involvement of guarantor in teaching	Lectures				
Lecturer	Doc. Ing. Jaroslav Havlík, Ph.D. (100 %)				

Short content of lectures and seminars

Lectures:

- Fundamentals of fluid flow.
- Principles of heat transfer.
- Sterilation.
- Prediction of Drying Time and Design of Food dryer for requested capacity.
- Design and performance evaluation of dryers.
- Design and performance evaluation of evaporation and freeze concentration.
- Food packaging engineering.
- Kinetics of food deterioration and shelf-life prediction.
- Extraction and distillation engineering.
- Emerging technologies (heat treatment, high pressure treatment, pulsed electric field, cold plasma treatment).
- Membrane concentration of liquid foods.
- Dry heat treatment of powders like dry egg white.

Seminars:

Praktické bloky cvičení na výzkumném ústavu potravinářském Praha (VÚPP)

- Heat treatment.
- Heat treatment.
- Heat treatment.
- High pressure treatment.
- High pressure treatment.
- High pressure treatment.
- Dry heat treatment of spice.
- Dry heat treatment of spice.
- Dry heat treatment of spice.
- Rheology of foods.
- Rheology of foods.
- Rheology of foods.

Literature

CAMPBELL-PLATT, G. (Ed.). (2017). Food science and technology. John Wiley & Sons.
FELLOWS, P. J. (2009). Food processing technology: principles and practice. Elsevier.

Title of the study course	**Sustainable Agriculture**				
Type of the study course	Compulsory elective			**Recommended study year / semester**	1/WS
Semester hours	24 lectures, 24 seminars	**hours**	48	**ECTS**	5
Type of students´ assessment	Credit, exam			**Study form**	Lectures, seminars
Description of study assessment and further requests	Credit – active participance on lectures and seminars, written tests, seminar work on given topic and its presentation Exam – written + oral exam				
Guarantor of study course	Theresa Piskackova, Ph.D.				
Involvement of guarantor in teaching	Lectures, seminars				
Lecturer	Theresa Piskackova, Ph.D. (100%)				

Short content of lectures and seminars

Lectures:

- Global issues of agriculture.
- History of traditional and alternative farming systems.
- Farm crises and consequences.
- Principals and definitions of sustainability.
- Soil care, plant nutrition, and biological cycles.
- Wetland function in agroecosystems.
- Permaculture.
- Agroforestry.
- Animal husbandry.
- Community Supported Agriculture.
- Precision farming and responsible application.
- Role of biotechnology to sustainability.

Seminars:

- Characteristics of different agriculture systems.
- Regional farming challenges- students present on current agriculture around the globe.
- Critical evaluation of video resources.
- Role of livestock in vegetation.
- Efficient use of water, strategies to overcome water scarcity.
- Role of biodiversity and ecosystem services in agriculture.
- Elements of permaculture in landscape design.
- Considering animal welfare.
- Unintended consequences: balancing social, economic, and ecological goals.
- Elements of scientific literature, practice understanding and critically evaluating results.
- Individual research on a topic and preparation of report.
- Class presentations.

Literature

HESTER, R., E., HARRISON, R., M. (Eds) Sustainability in Agriculture. The Royal Society of Chemistry. Cambridge, UK, 2005. 130 p.
Study materials accessible via Learning Management System of CULS - Moodle. Available at moodle.czu.cz
REDDY, K., R.; HODGES, H., F. Climate Change and Global Crop Productivity. CABI, UK, 2000: 472 p.
ŠARAPATKA, B., NIGGLI, U. et al. Agriculture and Landscape. Palacký University, Olomouc, Czech Republic, 2012: 267 p.
BOLLER, E., F., HÄNI, F., POEHLING, H. M. (Eds.) Ecological infrastructures. Ideabook on Functional Biodiversity at the Farm Level, LBL, Switzerland, 2004: 212 p
LICHTFOUSE, E. (Ed) Sustainable Agriculture Reviews 6, Alternative Farming Systems, Biotechnology, Drought Stress and Ecological Fertilisation, Springer, 2010: 354 p

Title of the study course	**Soil Conservation and Protection**				
Type of the study course	Compulsory elective			**Recommended study year / semester**	1/WS
Semester hours	24 lectures, 24 seminars	**hours**	48	**ECTS**	5
Type of students´ assessment	credit, exam			**Study form**	Lectures, seminars
Description of study assessment and further requests	Credit – presence on seminars, tests Exam – written + oral exam				
Guarantor of study course	prof. Ing. Josef Kozák, DrSc.				
Involvement of guarantor in teaching	Lectures				
Lecturers	prof. Ing. Josef Kozák, DrSc. (60%), doc. Ing. Ondřej Drábek, Ph.D. (30%), Ing. Lenka Pavlů, Ph.D. (10%)				

Short content of lectures and seminars

Lectures:

- Problems of soil conservation and protection.
- The main soil functions.
- Soil as a porous media.
- Soil compaction.
- Desertification process.
- Soil degradation - principles
- Soil contamination.
- Pesticides in the soil environment.
- Modelling of pesticides interactions with soil and resistant chemicals in soil.
- Man made soils.
- Soil degradation acidification.
- EU soil thematic strategy.

Seminars:

- Setting of the semestral work.
- Homework on projects.
- Homework on projects.
- Homework on projects.
- Consultation on project, delivering of partial results.
- Homework on projects.
- Evaluation of projects, partial examination (written).
- Field excursion - contaminated regions.
- Field excursion - contaminated regions.
- Application of pedotransfer rules.
- Modelling of soil degradation.
- Final evaluation of projects.

Literature

PIERZYNSKI, G. M., SIMS, T. J., VANCE, G. F. 2000. Soils and Environmental Quality, 2nd edition. CRC Press, Boca Raton, ISBN 0849300223
KOZAK, J. 2018. Soil conservation and protection. Study materials on the MOODLE system of CULS Prague.
BLUME, H. P., FELIX-HENNINGSEN, P. (1995-2005) Handbuch der Bodenkunde. Ecomed. Biowissenchaften. ISBN 3-609-72210-X.
ADRIANO, D.C. 2001. Trace Elements in Terrestrial Environments. Second Edition. Springer, New York, ISBN 0-387-98678-2.
SUMNER, M. (ed.). 1999. Handbook of Soil Science. CRC Press, Boca Raton, ISBN 0-8493-3136-6.
LAL, R. (ed.). 2002. Encyclopedia of Soil Science. Marcel Dekker, New York, ISBN 0-8247-0846-6.
GOBRAN, G. R., WENZEL, W. W., LOMBI, E. 2000. Trace Elements in the Rhizosphere. CRC Press, Boca Raton, ISBN

Title of the study course	**Environment pollution and remediation**				
Type of the study course	Compulsory elective			**Recommended study year / semester**	1/WS
Semester hours	24 lectures, 24 seminars	**hours**	48	**ECTS**	5
Type of students´ assessment	Credit, exam			**Study form**	Lectures, laboratory practices
Description of study assessment and further requests	Credit – seminar work ant its defense before others Exam – online test (via IS Moodle)				
Guarantor of study course	prof. Ing. Jiřina Száková, CSc.				
Involvement of guarantor in teaching	Lectures, laboratory practices				
Lecturer	prof. Ing. Jiřina Száková, CSc. (100%)				

Short content of lectures and seminars

Lectures:

- Global sources of the environmental pollution, pollution rate, toxicity, human risk.
- Toxic substances in the environment, their retention ad losses.
- Inorganic contaminants in the biogeochemical cycle, their transport for long distances.
- The risk element pollution of the environment, their availability for plants and animals.
- The organic pollutants, their characterization, sources and fate in the environment.
- Polyaromatic hydrocarbons, polychlorinated biphenyls, their sources and risks.
- Pharmaceuticals and personal care products.
- The mechanisms limiting accumulation of the harmful substances in plants.
- Ex-situ techniques for removal of pollutants from sills and sediments – principles and environmental aspects.
- In-situ techniques for permanent removal of contaminants from soils (soil washing, electrochemical decontamination, etc.).
- Biological approaches for the decontamination of the environment – advances and limitations.
- Phytoremediation, phytostabilization, the role of rhizosphere and mycorrhiza, risk substances accumulating plants.

Laboratory practices:

- The overview of the main environmental pollutants.
- Selection, sampling and pre-treatment of contaminated soil.
- Determination of wide range of organic and inorganic pollutants in the prepared soil I.
- Determination of wide range of organic and inorganic pollutants in the prepared soil II.
- Determination of wide range of organic and inorganic pollutants in the prepared soil III.
- Assessment of the determined pollutant levels I.
- Assessment of the determined pollutant levels II.
- Bioremediation methods.
- Phytoremediation methods.
- Stabilization methods of soil contamination.
- Remediation of PPCPs in soil and water.
- Presentation of the estimated environmental risk and proposed remediation/bioremediation measures.

Literature

ALLOWAY, B. J. (2013) Heavy Metals in Soils. Springer Berlin.
ADRIANO D. C. (2001) Trace Elements in Terrestrial Environment: Biogeochemistry, Bioavailability and Risks of Metals. Springer: New York, USA.
KABATA-PENDIAS, A., PENDIAS, H. (2001) Trace Elements in Soils and Plants. 3rd ed. CRC Press. Boca Raton, USA.
HALDEN, R. U. (2010) Contaminants of Emerging Concern in the Environment: Ecological and Human Health Considerations. Book Series: ACS Symposium Series 1048
SINGH S.N., TRIPATHI R. D. (2007) Environmental Bioremediation Technologies, Springer Berlin, SRN.
www.moodle.czu.cz
SROGI, K. 2007. Monitoring of Environmental Exposure to Polycyclic Aromatic Hydrocarbons: a review. Environmental Chemical Letters 5. 169-195.
CAMPANELLA et al. (2001) Plant Use to Face with PCBs and PCDD/Fs: Current Potential and Prospects .Environ Sci & Pollut Res, 1-13.

PFAFFLIN and ZIEGLER (2006) Encyclopedia of Environmental Science and Engineering. Taylor & Francis Group, LLC, Boca Raton, USA.

Title of the study course	**Agricultural and Environmental Microbiology**				
Type of the study course	Compulsory elective			**Recommended study year / semester**	1/WS
Semester hours	24 lectures, 24 seminars	**hours**	48	**ECTS**	5
Type of students´ assessment	Credit, exam			**Study form**	Lectures, seminars (laboratory practices)
Description of study assessment and further requests	Credit – laboratory protocols and presentation Exam – exam test + oral exam				
Guarantor of study course	doc. Ing. Věra Neužil Bunešová, Ph.D.				
Involvement of guarantor in teaching	Lectures, seminars				
Lecturer	doc. Ing. Věra Neužil Bunešová, Ph.D. (90% lectures, 10% seminars), prof. Ing. Luděk Žůrek, Ph.D. (10% lectures), Ing. Nikol Modráčková, Ph.D. (90 % seminars)				

Short content of lectures and seminars

Lectures:

- Introduction to microbiology.
- Structure and function of bacterial cells with respect to their survival in the environments and technology applications.
- Genetics of microorganisms and their modifications. Systematic of prokaryotes. Analysis of microbial communities.
- Fungi - yeasts & micromycetes and their role in the environment.
- Influence environmental factors on microorganisms.
- Impact of microbial metabolism on agricultural systems.
- Role of microorganisms in biotechnology.
- Role of antibiotics in animal and human health, their impacts on the environment.
- Microbial transformations of the C, N, P, S – substances. Mainly respiration & fermentation processes common in the environment. Ammonification, nitrification, denitrification, nitrogen fixation.
- Soil microbiology (humification, mineralization, and immobilization).
- Water microbiology (tap - surface - wastewater and its treatment).
- Food and feed microbiology (microbiology of milk & milk-fermented products, plant microbiology & sauerkraut, silage).
- Microbial toxins. Foodborne diseases & zoonoses.
- Microbiota of the digestive tract.

Seminars/Labs:

- Microscope and stain techniques, the morphology of prokaryotic microorganisms – simple staining, Gram staining, negative staining.
- Isolation of microorganisms from the environment using culture-dependent techniques, basic identification based on cultivation and morphological characteristics.
- Identification and characterization of isolated microorganisms by the biochemical tests.
- Microbial identification using MALDI-TOF MS.
- Antibiotic resistance & sensitivity testing.
- Water microbiology testing.
- Wastewater treatment (excursion).
- Cultivation analysis of fermented foods/feeds (yogurts, sauerkraut, silage) and probiotic supplements.

Zoonoses (seminar).

Literature

www.moodle.czu.cz
BUNEŠOVÁ V. 2017. Fundamentals of Microbiology. CULS, PowerPrint, 90 s., ISBN 978-80-213-2757-3.
PRESCOTT L. M. et al. 1996. Microbiology. WCB Publishers, London, 935 s. ISBN 0-697-29390-4
MADIGAN M. T., MARTINKO J. M., BENDER K. S., BUCKLEY D. H., STAHL D. A. (2015) Brock biology of microorganisms, Pearson Education Limited, England, 1030 s.
PERRY J. J., STALEY J. T., LORY S. 2002. Microbial life, Sinauer associates Sunderland, 811 s.

Title of the study course	**Special Food Biotechnology**				
Type of the study course	Compulsory elective			**Recommended study year / semester**	1/SS
Semester hours	24 lectures, 24 seminars	**hours**	48	**ECTS**	5
Type of students´ assessment	Credit, exam			**Study form**	Lectures, seminars
Description of study assessment and further requests	Credit – practical training, ongoing control of protocols, pictures (recording from microscopy) and knowledge control Exam – exam test and based on the result even oral exam				
Guarantor of study course	doc. Ing. Jiří Killer, Ph.D.				
Involvement of guarantor in teaching	Lectures, laboratory practices				
Lecturer	doc. Ing. Jiří Killer, Ph.D. (100%)				

Short content of lectures and seminars

Lectures:

- Microorganisms used in microbial food biotechnology, their classification.
- Fermentation processes, History, Microbial growth kinetics.
- Batch and continuous fermentation processes, Microbial growth media.
- Microbial metabolic pathways leading to important food/feed products, Microbial gene manipulation.
- Microbial enzymes used in the food industry/biotechnologies.
- Fermented dairy products.
- Fermented vegetable products, fermented fruit beverages.
- Fermented meat products / Food ingredients produced by particular microorganisms.
- Preservation techniques for long-term storage of microorganisms.
- Fungi and microalgae in food biotechnology.
- Yeasts in the bakery industry, yeasts as food and feed.
- Probiotics, prebiotics, synbiotics, psychobiotics, Parabiotics and Postbiotics.
- Production of alcoholic beverages through yeast alcoholic fermentation, production of vinegar.
- Methods of microbial identification.

Seminars (practical training):

- Microscopy of bacteria, yeasts and micromycetes:
- Preparation of liquid cultivation media for aerobes and anaerobes.
- Growth curve parameters – calculation, Calculation of enzymatic activities.
- Kefir – preparation / microscopy of kefir culture.
- Evaluation of the quality of kefir and fermented cabbage.
- Yogurt production: protocol.
- Evaluation of yoghurt quality.
- Excursion to the brewery, research / biotechnological laboratory.
- Bread production.
- Freeze-drying of probiotic bacteria, the morphology of probiotics occurring in freeze-dried synbiotics.

Literature

JAY, J. M. et al. (2005) Modern Food Microbiology. Springer, USA, 790 s., ISBN 0-387-23180-3 (e-book ISBN 0-387-23413-6).
BUNEŠOVÁ, V. (2017) Fundamentals of Microbiology. CULS, PowerPrint, 90 s., ISBN 978-80-213-2757-3.
www.moodle.czu.cz
PRESCOTT, L. M. et al. (1996) Microbiology. WCB Publishers, London, 935 s. ISBN 0-697-29390-4.
MADIGAN, M. T., MARTINKO, J. M., BENDER, K. S., BUCKLEY, D. H., STAHL, D. A. (2015) Brock biology of microorganisms, Pearson Education Limited, England, 1030 s.

Title of the study course	**Agricultural Policy**				
Type of the study course	Compulsory elective			**Recommended study year / semester**	1/SS
Semester hours	24 lectures, 24 seminars	**hours**	48	**ECTS**	5
Type of students´ assessment	Credit, exam			**Study form**	Lectures, seminars
Description of study assessment and further requests	Credit – partial seminar tests, individual project, specific requirements for obtaining the credit will be announced by the teacher at the beginning of the semester Exam – test + oral exam				
Guarantor of study course	doc. Ing. Karel Tomšík, Ph.D.				
Involvement of guarantor in teaching	Lectures				
Lecturer	doc. Ing. Karel Tomšík, Ph.D. (100%)				

Short content of lectures and seminars

Lectures:

- Introduction, relation of economy and policy – agrarian policy.
- Theory, objectives, actors and tools of agrarian and economic policies.
- Conceptual approach and typology of agrarian and economic policies (development).
- Interventionist and neo-conservative agrarian policy in the context of economic policy – trends.
- Economic-political connections of global problems, globalization trends in relation to the agrarian sector.
- European integration and economy policy in the context of agrarian policy.
- Specifics of European Agriculture.
- Common Agricultural Policy in a historical context.
- Common Agricultural Policy (CAP) - European agricultural model and EU budgetary policy.
- Agricultural policy in the context of Czech economic policy.
- External agrarian and economy policy – foreign trade, labour.
- Sustainable development and economic policy in relation to agrarian policy.

Seminars:

- Introduction to seminars. Seminar essays and presentations topis, teams, timetable.
- Agricultural policies and agricultural trade, essays presentations and evaluation.
- Agricultural policies of the world agricultural producers, essays presentations and evaluation.
- Agricultural policies and world institutions, essays presentations and evaluation.
- CAP and EU-intra trade with agricultural commodities, essays presentations and evaluation.
- CAP and EU-extra trade with agricultural commodities, essays presentations and evaluation.

Literature

BALDWIN, R., WYPLOSZ, C.: The Economics of European Integration. 5th edition, McGraw-Hill Higher Education, 2015, ISBN: 978-0077169657
BENOSSY-QUERE, R. E. et al. Economic policy – Theory and practice. Oxford, Oxford University Press. 2010. ISBN: 9780195322736.
OECD: Evaluation of Agricultural Policy Reforms in the European Union. OECD Publishing, 2017. ISBN: 978926427878-3
OOSTERVEER, P., SONNENFELD, D. A. Food, Globalization and Sustainability. New York: Earthscan, 2012, 282 p., ISBN 978-1-84971-261-3.
ACKRILL, R. Common agricultural Policy. Continuum International Publishing Group, 1. 11. 2000
TANSEY, G., WORSLEY T. The Food System. A Guide. London; Sterling, VA : Earthscan 2008. ISBN: 9781601197078.
European Commission: The Common Agricultural Policy. https://ec.europa.eu/info/food-farming-fisheries/key-policies/common-agricultural-policy_en
Economic Policy – Journal published by Wiley Online Library - onlinelibrary.wiley.com

Title of the study course	**Sensory Analysis of Food**				
Type of the study course	Elective			**Recommended study year / semester**	1/WS
Semester hours	12 lectures, 24 seminars	**hours**	36	**ECTS**	4
Type of students´ assessment	Credit, exam			**Study form**	Lectures, seminars
Description of study assessment and further requests	Credit: presence on seminars, protocols, presentation of sensory analysis results Exam: written and oral exam				
Guarantor of study course	prof. Ing. Lenka Kouřimská, Ph.D.				
Involvement of guarantor in teaching	Lectures				
Lecturer	prof. Ing. Lenka Kouřimská, Ph.D. (100%)				

Short content of lectures and seminars

Lectures:

- Introduction and history of sensory analysis. Basic terms and definitions. Sensory perception. Sensory receptors and their classification.
- Sense of taste and flavour. Sense of smell. Sense of sight.
- Sense of hearing. Senses of touch. Sensory assessment of food texture. Sense of temperature. Sense of pain.
- Psychophysics. Factors influencing sensory perception. Methodical questions of sensory analysis.
- Methods for sensory analysis of food. Consumer tests.
- Sensory quality and its evaluation. Perspectives of sensory analysis. New methods in sensory analysis.

Seminars:

- Detection and recognition of odours. Intensity of colour ranking test.
- Ranking test of odour intensity.
- Test of investigating sensitivity of taste.
- Threshold testing.
- Pudding consistency evaluation.
- Paired comparison test of differentiation threshold.
- Taste memory test.
- Texture of pears evaluation.
- Discrimination test, triangle test.
- Discrimination test, duo-trio test.
- Ranking test of taste intensity. Paired comparison preference test.
- Scales in sensory analysis. Detection of odours - use of Sniffin'Sticks odour pens.

Literature

PIGGOTT, J. R. 1988. Sensory analysis of foods, Elsevier Applied Science, London, 426 s.
LAWLESS H. T. Sensory Evaluation of Food, Kluwer Academic Publishers,1998.
JELLINEK, G. 1985. Sensory evaluation of food theory and practice. Ellis Horwood. Chichester. 429 p.
CIVILLE, G. V., CARR, B. T. 2015. Sensory evaluation techniques. CRC Press. Boca Raton. 512 p.
ISO normy k dané problematice.

Title of the study course	**Food Quality and Food Safety**				
Type of the study course	Elective			**Recommended study year / semester**	1/WS
Semester hours	24 lectures, 22 seminars, 2 terrain courses	**hours**	48	**ECTS**	5
Type of students´ assessment	Credit, exam			**Study form**	Lectures, seminars
Description of study assessment and further requests	Credit: semestral project Exam: Written and oral				
Guarantor of study course	doc. Ing. Adéla Fraňková, Ph.D.				
Involvement of guarantor in teaching	Lectures				
Lecturer	doc. Ing. Adéla Fraňková, Ph.D. (100%)				

Short content of lectures and seminars

Lectures:

- Introduction to food safety and security, definition of basic terms, legislative framework, current issues related to food safety.
- Food systems, international organizations ensuring food safety and security and their relations, authorities involved in food control.
- Basic of food toxicology, bioavailability of contaminants, methods to evaluate exposure of human to xenobiotics (HI, PODI, AOP).
- Food additives – preservatives – antioxidants, antimicrobials.
- Food additives – texturizers, emulsifiers.
- Food additives – food colourings, aromas, sweeteners, taste enhancers.
- Food additives – enzymes, novel food additives.
- Contaminants in food – natural toxins, antibiotics, and pesticide residues in food.
- Contaminants in food – persistent organic pollutants, risk elements.
- Contaminants in food – endocrine disruptors, process contaminants.
- Contaminants in food – irradiation; GMO.
- Contaminants in food – novel contaminants in food.

Seminars and terrain courses:

- Key laboratory skills, assignment of semestral work.
- Solving outbreak - case study.
- Influence of emulsifiers on the quality of bakery products.
- Influence of sweeteners on food taste and texture.
- Determination of nitrates in food.
- Determination of alkaloids in food.
- Honey adulteration - part 1.
- Honey adulteration – part 2.
- Determination of antioxidants in chewing gum by GC/FID.
- PAH extraction by QuEChERS method.
- Determination of antibiotics residues in meat by EEC 4 plate test.
- Determination of risk eglements in food by P-XRF, evaluation of semestral work, test.

Literature

D'MELLO, JP FELIX, ed. Food safety: contaminants and toxins. CABI, 2003.
BRANEN, A. LARRY, P. MICHAEL DAVIDSON, SEPPO SALMINEN, and JOHN THORNGATE, eds. Food additives. CRC Press, 2001.
KIRCHSTEIGER-MEIER, EVELYN, and TOBIAS BAUMGARTNER, eds. Global food legislation: an overview. John Wiley & Sons, 2014.
SHAW, IAN C. Food safety: the science of keeping food safe. John Wiley & Sons, 2012.
MSAGATI, TITUS AM. The chemistry of food additives and preservatives. John Wiley & Sons, 2012.
BHAT, RAJEEV, and VICENTE M. GÓMEZ-LÓPEZ, eds. Practical food safety: Contemporary issues and future directions. John Wiley & Sons, 2014.
SHIBAMOTO, TAKAYUKI, and LEONARD F. BJELDANES. Introduction to food toxicology. Academic press, 2009.

SPIZZIRRI, UMILE GIANFRANCO, and GIUSEPPE CRILLO, eds. Food Safety: Innovative Analytical Tools for Safety Assessment. John Wiley & Sons, 2016.
Web pages:
http://www.efsa.europa.eu/
https://ec.europa.eu/food/safety/rasff_en

Title of the study course	**Sustainability in the Food Chain**				
Type of the study course	Elective			**Recommended study year / semester**	1/WS
Semester hours	12 lectures, 12 seminars	**hours**	24	**ECTS**	3
Type of students´ assessment	Credit, exam			**Study form**	Lectures, seminars
Description of study assessment and further requests	Credit: active participance on seminars Exam: written and oral				
Guarantor of study course	doc. Ing. Jaroslav Havlík, Ph.D.				
Involvement of guarantor in teaching	Lectures				
Lecturer	doc. Ing. Jaroslav Havlík, Ph.D. (20% lectures + seminars), Ing. Dana Kapitulčinová, Ph.D. (80% lectures + seminars)				

Short content of lectures and seminars

Lectures:

- The concept of sustainable development (definition, history, present) and global trends affecting food security (Anthropocene, The Great Acceleration).
- Environmental sustainability from the point of view of food systems (Planetary Boundaries, Millennium Ecosystem Assessment, IPCC Reports, etc.).
- Socio-economic aspects of sustainable food production and consumption (Externalities, Local Economies, Fair Trade, Animal Welfare and Ethics in Production, etc.).
- Sustainability and human nutrition (Sustainable Diets, Dietary Recommendations, Climate Change-related health impacts, etc.).
- Measurement and monitoring of sustainability of food systems and products (FAO SAFA Guidelines, Environmental Footprinting, LCA and LCSA, etc.).
- Interventions at the level of national and international policies and initiatives (Sustainable Development Goals, EU regulation, state regulation, education, etc.).

Seminars:

- Simulation of a (non) sustainable food system - an interactive practicum for the development of systems thinking and understanding the principles of sustainable development (Fishbanks simulation).
- Environmental limits of the Earth.
- Inclusion of externalities in the price of products.
- Balancing human nutritional requirements and environmental impacts.
- Sustainability assessment of the food product / company / system (working with the SAFA Tool or other sustainability tools and indicators).
- Simulation of international negotiations on new agri-food policies - an interactive internship for the development of cooperation and critical argumentation.

Literature

GODFRAY et al. (2010) Food Security: The Challenge of Feeding 9 Billion People, Science 327, 812-818.
STEFFEN et al. (2015) Planetary boundaries: Guiding human development on a changing planet, Science 1259855.
RAWORTH et al. (2012) A safe and just space for humanity: Can we live within the doughnut? Oxfam Discussion Paper, Oxfam International.
FAO (2014) Developing sustainable food value chains – Guiding principles. Rome.
FAO (2014) Sustainability Assessment of Food and Agriculture Systems (SAFA) Guidelines, version 3.0, Section 1 – Framework, pp. 1-22.
STEFFEN et al. (2015) The trajectory of the Anthropocene: The Great Acceleration. The Anthropocene Review 2, 81-98.
SMIL, V. (2015) Harvesting the Biosphere: What We Have Taken from Nature. MIT Press.
MASON & LANG (2017) Sustainable Diets: How Ecological Nutrition Can Transform Consumption and the Food System. Earthscan, Routlege.

Title of the study course	**Quality Assessment of Plant-Based Foods**				
Type of the study course	Elective			**Recommended study year / semester**	1/WS
Semester hours	24 lectures, 24 seminars	**hours**	48	**ECTS**	5
Type of students´ assessment	Credit, exam			**Study form**	Lectures, seminars
Description of study assessment and further requests	Credit: semestral work and identification test of discussed botanical species Exam: written and oral				
Guarantor of study course	Ing. Jan Tauchen, Ph.D.				
Involvement of guarantor in teaching	Lectures, seminars				
Lecturer	Ing. Jan Tauchen, Ph.D. (80% lectures + seminars), doc. Ing. Jaroslav Havlík, Ph.D. (20% lectures + seminars)				

Short content of lectures and seminars

Lectures:

- Introduction to quality and safety of plant-based products and methods used in their determination.
- Cereals and pseudocereals.
- Non-cereal plant species cultivated for starch and monosaccharides.
- Non-traditional and exotic oil crops.
- Non-traditional and exotic protein crops (legumes).
- Imported fruits & nuts I.
- Imported fruits & nuts II.
- Lesser-known vegetables I.
- Lesser-known vegetables II.
- Beverages & stimulants.
- Spices.
- Plant species used in manufacture of dietary supplements.

Seminars

- Introduction to basic laboratory skills.
- Determination of DPPH antioxidant activity of fruit juices.
- Determination of ORAC antioxidant activity of fruit juices.
- Determination of microbial damage of fruit juices.
- Determination of sesame oil adulteration with rapeseed oil by GC-MS.
- Validation of analytical chemistry methods and assignment of semester work.
- Determination of quality of rice by SPME-GC-MS.
- Basic and advanced determination of coffee quality.
- Principles in coffee roasting.
- Determination of degree of coffee roasting by HPLC-UV.
- Presentation of results of the semester work.
- Identification test.

Literature

KOKOŠKA, L., 2003. Spices, Aromatic and Medicinal Plants of Tropics and Subtropics. Česká zemědělská univerzita v Praze, Praha, Česká Republika.
REHM, S., ESPIG, G., 1991. The Cultivated Plants of The Tropics and Subtropics: Cultivation, Economic Value, Utilization. Margraf Verlag, Weikersheim, Germany.
DOWNEY, G., 2016. Advances in Food Authenticity Testing, 1st ed, Food Science, Technology and Nutrition. Woodhead Publishing, Duxford, UK.
WROLSTAD, R. E., ACREE, T. E., DECKER, E. A., PENNER, M. H., REID, D. S., SCHWARTZ, S. J., SHOEMAKER, C. F., SMITH, D. M., SPORNS, P., 2004a. Handbook of Food Analytical Chemistry. Vol 1: Water, Proteins, Enzymes, Lipids, and Carbohydrates, 1st ed. Wiley & Sons, Hoboken, USA.
WROLSTAD, R. E., ACREE, T. E., DECKER, E. A., PENNER, M. H., REID, D. S., SCHWARTZ, S. J., SHOEMAKER, C. F., SMITH, D. M., SPORNS, P., 2004b. Handbook of Food Analytical Chemistry. Vol 2: Pigments, Colorants, Flavors, Texture, and Bioactive Food Components, 1st ed. Wiley & Sons, Hoboken, USA.
JAIN, M. S., GUPTA, S. D., 2013. Biotechnology of Neglected and Underutilized Crops. Springer, Berlin, Germany.
VACLAVIK, V. A., CHRISTIAN, E. W., 2014. Essentials of Food Science, 4th ed. Springer, Berlin, Germany.

Title of the study course	**Quality Assessment of Animal-Based Foods**				
Type of the study course	Elective			**Recommended study year / semester**	1/SS
Semester hours	24 lectures, 24 seminars	**hours**	48	**ECTS**	5
Type of students´ assessment	Credit, exam			**Study form**	Lectures, seminars
Description of study assessment and further requests	Credit: written test Exam: written and oral exam				
Guarantor of study course	Ing. Daniel Bureš, Ph.D.				
Involvement of guarantor in teaching	Lectures				
Lecturer	Ing. Daniel Bureš, Ph.D. (20%, lectures), Ing. Eva Kudrnáčová, Ph.D. (30% lectures, 30% seminars), Ing. Veronika Legarová, Ph.D. (50% lectures, 20% seminars), Ph.D. students (50% seminars)				

Short content of lectures and seminars

Lectures:

- Animal products: consumption, importance in human nutrition, effect on human health.
- Assessment of carcass quality (cattle, pigs and lambs).
- Post-mortem process in meat, effect of ageing on meat texture.
- Intramuscular connective tissue and fat: effect on meat technological and eating quality.
- Methods used in meat quality assessment (physical, chemical and sensory analyses).
- Evaluation of colour in meat, eggs and other animal products.
- Raw milk quality requirements, diseases from milk, milk contaminants.
- Basic milk processing, heated milk and cream.
- Liquid milk products - principles of processing, milk and cream assessment.
- Butter, butter assessment, ice cream.
- Milk microbiology, fermented milk products.
- Cheese and quark, whey processing.

Seminars:

- Practical training of carcass grading.
- Excursion to the commercial slaughterhouse and meat processing company.
- Colour and haem pigment in meat.
- Lipids and animal fat: fat freshness assessment.
- Evaluation of quality of fish and fish products.
- Assessment of quality of egg yolk, egg white and shell.
- Honey quality evaluation.
- Analysis of liquid milk products, acidity, fat content.
- Analysis of cream and butter, fat content.
- Fermented milk products.
- Microbiological evaluation of milk and milk products.
- Cheese - sensory and chemical analysis, cheesemaking.

Literature

HUI, Y. H. et al. 2012. Handbook of Meat and Meat Processing, CRC Press. P 1000. ISBN 9781439836835
NOLLET, L. M. L., TOLDRÁ, F. 2010. Handbook of dairy foods analysis. CRC Press. Boca Raton. 900 p. ISBN 978-1-4200-4631-1.
PARK, Y. 2009. Bioactive components in milk and dairy products. Wiley-Blackwell. Ames. 426 p. ISBN 978-0-8138-1982-2.
TAMIME, A. Y. 2009. Dairy powders and concentrated milk products. Willey-Blackwell. Chischester. 380 p. ISBN 978-1-4051-5764-3.
LAVRIE, R. A., LEDWARD, D. A. 2006. Meat Science. Woodhead Publishing Limited. Cambridge P. 521. 978-1-84569-159-2.
BYLUND, G. 1995. Dairy processing handbook. Lund. Sweeden Tetra Pak processing Systems AB. p. 436

Title of the study course	**Food, Beverages and Dietary Supplements**				
Type of the study course	Elective			**Recommended study year / semester**	1/SS
Semester hours	24 lectures, 24 seminars	**hours**	48	**ECTS**	5
Type of students´ assessment	Credit, exam			**Study form**	Lectures, seminars
Description of study assessment and further requests	Credit: semestral project, presence, discussion Exam: written and oral				
Guarantor of study course	prof. Ing. Lenka Kouřimská, Ph.D.				
Involvement of guarantor in teaching	Lectures				
Lecturer	prof. Ing. Lenka Kouřimská, Ph.D. (100%)				

Short content of lectures and seminars

Lectures:

- Introduction, information about the course.
- Basic terms, the evolution of human diet.
- Milk and dairy products.
- Edible fats and oils.
- Fruit and vegetables, natural antioxidants.
- Meat products.
- Cereals and cereal products.
- Fish, seafood, and exotic products.
- Cocoa processing, chocolate, and honey.
- Beans, lentils, and other legumes.
- Alcoholic and non-alcoholic beverages.
- Food additives and dietary supplements.

Seminars:

- Enzymatic and non/enzymatic browning reactions in food.
- Lipid oxidation and hydrolysis (rancidity) in food.
- Hydrolysis of proteins and carbohydrates in food.
- Factors affecting growth of bacteria (temperature, air, water, pH, nutrients…).
- Fermentation in food processing.
- Food preservation methods/techniques. Heat treatment in food processing.
- Food safety and food security. Food products from organic farming.
- Food information to consumers (Regulation (EU) No 1169/2011).
- Natural food toxins.
- Mechanical food contaminants prevention in food industry. Food processing contaminants.
- Metabolic food disorders (lactose intolerance, phenylketonuria, gout, homocystineuria, etc.).

Food reformulation. Nutrition and health claims (Regulation (EC) No 1924/2006).

Literature

POTTER, N. N., HOTCHKISS, J. H. Food Science. Springer Science + Business Media, New York, 1998, ISBN 978-1-4615-4985-7.
BRENNAN, J. G. Food Processing Handbook, WILEY-VCH Verlag GmbH & Co. KGaA, Weinheim, 2006, ISBN: 3-527-30719-2.
DEMAN, J. M. Principles of Food Chemistry. Springer Science + Business Media, New York, 1999, ISBN 978-1-4614-6390-0.
RAHMAN, M.S. Handbook of food preservation, CRC Press, 2007, ISBN 9781574446067.

Title of the study course	**Weed Science**				
Type of the study course	Elective			**Recommended study year / semester**	1/WS
Semester hours	24 lectures, 24 seminars	**hours**	48	**ECTS**	5
Type of students´ assessment	Credit, exam			**Study form**	Lectures, seminars (laboratory practices)
Description of study assessment and further requests	Credit – knowledge of weed plants at emergency stage, seminar work - project Exam – written test + oral exam				
Guarantor of study course	prof. Ing. Josef Soukup, CSc.				
Involvement of guarantor in teaching	Lectures, laboratory practices				
Lecturer	prof. Ing. Josef Soukup, CSc. (50%), Ing. Josef Holec, Ph.D. (25%), Theresa Piskackova, Ph.D. (25%)				

Short content of lectures and seminars

Lectures:

- Introduction to Weed Science. Characterisation of weeds and importance of weed management.
- Weed biology – reproduction, dispersion, seed dormancy, soil seed bank.
- Weed communities - influence of natural conditions and farming practices on community dynamics.
- Crop-weed interactions (competition, allelopathy, parasitism). Economic thresholds and critical periods.
- Integrated weed management – principles, characterisation of methods.
- Weed control methods. Efficacy, economical difficulty and usage of plant protection methods.
- Herbicides - modes of action, selectivity, application, intake, translocation.
- Environmental fate of herbicides.
- Herbicide resistance – emergence, mechanisms, prevention, management.
- Novel technologies in weed control - precision farming, herbicide tolerant varieties.
- Weed control in cropping systems (cereals, oil-seed crops, pulse crops).
- Weed control in cropping systems (maize, potatoes, sugar beet and vegetables).

Seminars:

- Introduction, visit of experimental facilities, distribution of topics for the semestral project.
- Identification of weed propagules.
- Soil sampling and analysis of soil seed bank.
- Seed dormancy and factors affecting the seed germination.
- Identification of weeds in the field.
- Evaluation of herbicide efficacy and selectivity – greenhouse and field experiments.
- Integrated Weed Management (IWM) - introduction to the project.
- Work with List of Registered Plant Protection Products and practical guidelines.
- Detection of herbicide resistance (greenhouse and molecular lab).
- Individual work on the project (2 weeks).
- Defence of the project.

Literature

ZIMDAHL, H. R. 2007. Fundamentals of Weed Science. Accessible from http://www.agrifs.ir/sites/default/files/Fundamentals%20of%20Weed%20Science,%20Third%20Edition%20%7BRobert%20L%20Zimdahl%7D%20%5B9780123725189%5D%20(Academic%20Press%20-%202007).pdf
NAYLOR, R. E. L. 2002. Weed Management Handbook. Ninth Edition. Blackwell Science, Oxford, 423 p.
BÖRNER, H. 1995. Unkrautbekämpfung. Gustav Fischer Verlag Jena, Jena, 315 p.
COUSENS, R., MORTIMER, M. 1995. Dynamics of weed populations. Cambridge University Press, Cambridge, 332 p.
LIEBMAN, M., MOHLER, C. L., STAVER, C. P. 2001. Ecological management of agricultural weeds. Cambridge University press, 532 p.
Materiály z přednášek budou umístěny na www.moodle.czu.cz.

Title of the study course	**Agricultural Ecology**				
Type of the study course	Elective			**Recommended study year / semester**	1/WS
Semester hours	24 lectures, 12 seminars	**hours**	36	**ECTS**	4
Type of students´ assessment	Credit, exam			**Study form**	Lectures, seminars
Description of study assessment and further requests	Credit – presence at seminars, semestral work Exam – written exam from theoretical and practical knowledge from the course				
Guarantor of study course	prof. RNDr. Miroslav Barták, CSc.				
Involvement of guarantor in teaching	Lectures, seminars				
Lecturer	prof. RNDr. Miroslav Barták, CSc. (100%)				

Short content of lectures and seminars

- Agroecology: definition. Agroecosystem: structure and functions, energomaterial and information fluxes.
- Determinants of agroecosystem: Conditions and resources, ecology of tolerance.
- Populations in agroecosystem: Dynamics, fitness, competition in monocultures, niche, General and special agro-biocenology: Biotic relations, bioregulation, phytophagy, mutualisms.
- Agricultural geoecology: Origin and structure of managed landscape, biodiversity.
- Evolution of agroecosystem: Origin and spreading of agriculture.
- Soil ecology: Edaphon, impact of cultivation, management of soil resources.
- Biogeochemistry of agroecosystem: Cycles of nutrients, N management at farm level.
- Production ecology and yield relations, crop adaptation and improvement.
- Management of successionally mature agroecosystems, energy relations and disturbances.
- Agricultural systems: HEIA, LEIA, organic and conventional farming, biodiversity and reliability of farming systems.
- Negative environmental impacts of agriculture: Habitat changes, adjacent areas, global change, Socio-economic environment: Agricultural policy; food, farm, resource and rural policy, environmental services.
- Sustainable agriculture: Alternative and traditional farming systems, germplasm management.

Literature

Presentations from lectures available in IS Moodle, students will receive the supplementary texts from guarantor

S. R. GLIESSMAN. Agroecology, CRC Press, ISBN: 1439-89561-9, 2014, 405 pp

MENDEZ VE, BACON CM, COHEN R, GLIESSMAN SR. Agroecology: a Transdisciplinary, Participatory and Action-Oriented Approach. 2015. ISBN: 1482-24176-5, CRC Press, 268 pp.

Title of the study course	**Environmental Analytical Chemistry**				
Type of the study course	Elective			**Recommended study year / semester**	1/WS
Semester hours	24 lectures, 24 seminars	**hours**	48	**ECTS**	5
Type of students´ assessment	Credit, exam			**Study form**	Lectures, laboratory practices
Description of study assessment and further requests	Credit – written test (2x) + credit test (1x) Exam – exam test (1x) + oral exam				
Guarantor of study course	doc. Ing. Petr Kačer, Ph.D.				
Involvement of guarantor in teaching	Lectures, laboratory practices				
Lecturer	doc. Ing. Petr Kačer, Ph.D. (100%)				

Short content of lectures and seminars

Lectures (major topics):

- Stratospheric chemistry. Ozone layer, ozone holes.
- Chemistry of ground-level air pollution. Environmental and health consequences of polluted air. Indoor pollution.
- Detailed chemistry of the atmosphere. Analytic techniques for air.
- Greenhouse effect. Fossil-fuel emissions. Global warming.
- Alternative fuels. Hydrogen economy. Radioactivity – radon, nuclear energy.
- Pesticides.
- Dioxins, furans and PCBs.
- Other toxic organic compounds of environmental concern. GC analysis. HPLC analysis.
- Chemistry and analytics of natural waters. Wastewater analytics. Pollution of water.
- Water purification processes.
- Toxic heavy metals. Analysis of plastics.
- Wastes, solids and sediments.

Seminars (laboratory practices/excursions):

- Water quality. Determination of water parameters (hardness,Ca, Mg). Determination of formaldehyde with iodometry.
- Atomic absorption spectrometry. Quantitation of toxic heavy metals in agricultural crops and soil.
- Quantitation of nitrates by ISE.
- Quantitation of Hg in sewage sludge by AMA-254.
- Analysis of dioxins, furans and PAH in chimney smoke sediment.
- GC separation and quantitation of triazines. SPE and liquid-liquid extraction.
- Brominated fire retardants in plastics by LC.
- Water quality. Biological and chemical oxygen demand. Measuring pH/pE of rain samples and mine effluents.
- Analysis of pesticides and pesticide degradation products by QUECHERS and LC-MS.
- Excursion – analysis of air pollutants. On-line measuring devices and stations.
- Water quality. Analysis of chlorination byproducts in drinking water.
- Air analysis – radon

Literature

BAIRD, C., M. Cann. Environmental chemistry, 5e, Freeman, 2012, ISBN - 978-1429277044.
REEVE R. N. Introduction to Environmental Analysis, 1e, Wiley, 2002. ISBN - 978-0471492955.
VAN LOON G. W. Environmental chemistry: A global perspective, Oxford University Press, 4e, 2018, ISBN-13: 978-0198749974
SCHWARZENBACH, R. P. Environmental organic chemistry, Wiley, 3e, 2016, ISBN-13: 978-1118767238
SEINFELD, J. H. Atmospheric chemistry and physics, Wiley, 3e, 2016, ISBN-13: 978-1118947401

Title of the study course	**Livestock Management**				
Type of the study course	Elective			**Recommended study year / semester**	1/SS
Semester hours	24 lectures, 24 seminars	**hours**	48	**ECTS**	5
Type of students´ assessment	Credit, exam			**Study form**	Lectures, seminars
Description of study assessment and further requests	Credit – seminar's project Exam – written test + oral exam				
Guarantor of study course	doc. Ing. Luděk Stádník, Ph.D.				
Involvement of guarantor in teaching	Lectures, laboratory practices				
Lecturers	doc. Ing. Luděk Stádník, Ph.D. (52% lectures + seminars), doc. Ing. Jaroslav Čítek, Ph.D. (16% lectures + seminars), doc. Ing. Lukáš Zita, Ph.D. (16% lectures + seminars), Ing. Martin Ptáček, Ph.D. (8% lectures + seminars), Ing. Cyril Neumann, Ph.D. (8% lectures + seminars)				

Short content of lectures and seminars

Lectures:

- The importance of cattle breeding.
- Biological basics of milk production.
- Biological basics of beef production.
- Fertility and health of cattle - Indicators, evaluation, prevention of disorders.
- Production types of cattle.
- Principles of farm management, rearing and breeding management of individual categories of dairy cattle.
- The importance of sheep breeding.
- Sheep fertility, milk and meat production.
- Poultry production systems.
- Management relations of poultry breeding.
- Pig production systems.
- Management relations of pig breeding.

Seminars:

- Production systems of cattle breeding, organic farming.
- Economical basics of milk production.
- Economical basics of beef production.
- Fertility and health of cattle - longevity and herd reproduction, cattle breeds.
- Breeding programs for cattle, work of breeders.
- Rearing and breeding management of individual categories of beef cattle.
- Sheep production traits, by-products, sheep breeds.
- Management and technology used in sheep breeding.
- Management and technology of hen breeding and broiler fattening.
- Economic relations of poultry breeding.
- Breeding of individual pig categories.
- Economic relations of pig breeding.

Field Exercise / Excursion: Visit to a specific farm

Project: individual projects focusing on individual sectors of animal production, aspects of their management, relation to quality of production and environmental impact; presented during individual lectures.

Literature

PHILLIPS, C J C. Principles of cattle production. Wallingford: CABI Publishing, 2010. ISBN 0-85199-438-5.
COLE, D. J. A., WIESEMAN, J., VARLEY, M. A. (1994) Principles of Pig Science. Nottingham Univ. Press. ISBN 1-897676-22-0
BELL D, WEAVER W. (2002) Chicken meat and egg production, Kluwer Acad. Publ., Dordrecht, vydání 5
C. WATHES et al.(1994) Livestock housing, CABI Publ., ISBN 0851987745
ALBRIGHT J. L., ARAVE C. W. 1997. The Behaviour of Cattle. CAB International, 306 p. ISBN 0-85199-196-3
Ball P. J. H., Peters A. R. 2007. Reproduction in cattle. Blackwell Publishing, Great Britain, 242 p. ISBN 978-1-4051-1545-2

ANDRIEU S., WARREN H. 2009. Ruminant formula for the future: nutrition or pathology? Wageningen Academic Publishers. 95p. ISBN 978-90-8686-105-7
EUROPEAN ASSOCIATION FOR ANIMAL PRODUCTION., -- KLOPČIČ, M. Breeding for robustness in cattle. Wageningen, The Netherlands: Wageningen Academic, 2009. ISBN 978-90-8686-084-5.
CHILLIARD Y., 2009. Ruminant fysiology. Wageningen Academic Publishers. 864 p. ISBN 978-90-8686-119-4.
Hoards Dairyman, Hoard & Sons Company, Fort Atkinson, WI, USA
http//www.sheepandgoat.com
Pig International Magazine. Watt Publishing Company, USA
http//www.pigprogress.net/
Poultry International Magazine. Watt Publishing Company, USA
Materials on www.moodle.czu.cz

Title of the study course	**Fish Systematics**				
Type of the study course	Elective			**Recommended study year / semester**	1/SS
Semester hours	16 lectures, 32 seminars	**hours**	48	**ECTS**	5
Type of students´ assessment	Credit, exam			**Study form**	Lectures, seminars
Description of study assessment and further requests	Credit – seminar work and creation of phylogenetic tree of fishes Exam – fishes identification and general characteristics of identified fishes in the taxon				
Guarantor of study course	prof. Ing. Lukáš Kalous, Ph.D.				
Involvement of guarantor in teaching	Lectures, laboratory practices				
Lecturer	prof. Ing. Lukáš Kalous, Ph.D (80% lectures; 20% seminars); Ing. Miloslav Petrtýl, Ph.D. (20% lectures); Ph.D. students (80% seminars)				

Short content of lectures and seminars

Lectures

- Introduction to Fish Systematics.
- Cladistics, Nomenclature.
- Ichthyological methods I (fish collection, transportation, conservation, museum collections).
- Ichthyological methods II (osteology, external morphology, and other methods used in ichthyology).
- Mixini, Cephalaspidomorphi, Sarcopterigii.
- Chondrichthyes.
- Cladista, Chondrostei, Holostei, Lower Teleostei.
- Euteleostei.

Seminars:

- Assignment of the semester works.
- Cladistics and Phylogenetic tree of fishes.
- Fish morphology, meristic and morphometric features.
- Fish osteology.
- Ichthyological methods.
- Practical recognition of fishes (preserved specimens, projection of pictures and films).
- Presentation of student's semester works and discussion.

Literature

NELSON, J. S., GRANDE, T. C., & WILSON, M. V. (2016). Fishes of the World. John Wiley & Sons.
NELSON, J. S., GRANDE, T. C., & WILSON, M. V. (2016). Fishes of the World. John Wiley & Sons.
HELFMAN, G., COLLETTE, B. B., FACEY, D. E., & BOWEN, B. W. (2009). The diversity of fishes: biology, evolution, and ecology. John Wiley & Sons.
WINFIELD, I. J., NELSON, J. S., 1991 Cyprinid Fishes, Chapman & Hall, London, 667 pp
Materials at Moodle.czu.cz and Fishbase.de

Title of the study course	**Advanced Meteorology and Climatology**				
Type of the study course	Elective			**Recommended study year / semester**	1/WS
Semester hours	24 lectures, 24 seminars	**hours**	48	**ECTS**	5
Type of students´ assessment	Credit, exam			**Study form**	Lectures, seminars
Description of study assessment and further requests	Credit – presence on seminars, written test Exam – written + oral exam				
Guarantor of study course	doc. Dr. Mgr. Vera Potopová				
Involvement of guarantor in teaching	Lectures, seminars				
Lecturer	doc. Dr. Mgr. Vera Potopová (100 %)				

Short content of lectures and seminars

Lectures

- Fundamentals of weather and climate. History of meteorology and climatology. The climate system and its component. The concept of positive and negative climate feedback.
- Composition of the atmosphere, atmospheric structure, and the carbon cycle. Human-induced atmospheric change. Depletion of the Ozone layer. People and the environment: The UV Index. Greenhouse gases and the greenhouse effect.
- Energy in the climate system. The Sun is an energy source. Solar radiation balance. Forms of thermal energy transfer in the climate system: conduction, advection, convection and radiation. Changes in global energy balance components and climate feedbacks.
- Heat. Temperature. Heat Balance. Adiabatic processes. Temperature inversion, specific heat, sensible heat and latent heat. Effect of vegetation on air and soil temperatures. Degradation of permafrost. Projected change in global mean surface air temperature. Sea and ocean water temperatures, and positive feedback system.
- Cloud classification system. Precipitation and condensation forms.
- Water cycle. The potential evapotranspiration as a key component in water balance. Methods and models review of actual evapotranspiration, reference evapotranspiration and potential evapotranspiration.
- Air masses classification. The Bergeron classification. Types of atmospheric fronts. Weakening and strengthening of the front. Cyclones and Anticyclones. Characteristics of extratropical cyclone vs tropical cyclone.
- General atmospheric circulation. The general circulation single-cell model and the three-cell model: Hadley Cell, Ferrel Cell and Polar Cell. Inter-tropical convergence zone (ITCZ) and the monsoon circulation. Trade wind circulation. The polar front, Jet Streams, Rossby waves, troughs and ridges.
- Climate classification and climatic regions of the World.
- Climate change: impacts, adaptation, and vulnerability.
- Crop growth modelling and its applications in the ecosystem.
- Adverse weather events and their impacts on agriculture, society and water management.

Seminars

- Practices in using current main sources of meteorological observations. Global observing system.
- Practices in using solar time, times zones, and International Atomic Time. Standardization and homogenization of meteorological measuring methods and instrument calibration.
- Practices in measuring instruments of air pressure, pressure gradient and reduction of pressure at sea level.
- Practices in measuring instruments of temperature characteristics. Basic statistical and graphical processing of temperature characteristics.
- Practices in measuring instruments of air humidity variables and equivalent humidity characteristics.
- Practices in measuring instruments of the solar radiation balance.
- Practices in measuring instruments of the actual evapotranspiration, reference evapotranspiration and potential evapotranspiration.
- Practices in measuring instruments of the precipitation and snow characteristics.
- Practices in measuring instruments of speed and wind direction. The uses of wind energy.
- Project of assessment of the microclimate in the work environment, index of heat, thermal load of the organisms.
- Climate project and the subsequent presentation of temperature and precipitation conditions for chosen territories of the world using the international databases.

- Testing, credit and examination.

Literature

AGUADO, E., BURT, J. E. 2001. Understanding Weather & Climate, 2nd Ed. 505 pp. Prentice Hall. ISBN 0-13-027394-5.
DANIELSON, E. W., LEVIN J., ABRAMS, E. 1998. Meteorology. 462 pp. McGraw-Hill. ISBN 0-697-21711-6.
DONALD, AHRENS, C. 2012. Meteorology Today: An Introduction to Weather, Climate, and the Environment. Cengage Learning, Inc. 9th Edition. 527 pp. ISBN-13: 978-0495555735.
GEDZELMAN, S. D. 1980. The Science and Wonders of the Atmosphere. 535 pp. John-Wiley & Sons. ISBN 0-471-02972-6.
POTOPOVÁ, V. 2022. Study materials published on Moodle – teaching system for teaching support at the Czech University of Life Sciences in Prague. Available from https://moodle.czu.cz/.
POTOPOVÁ, V., CASTRAVEȚ, T., CHAWDHERY, MD. R.A. 2022. Introduction to climate change, modelling, and adaptation measures. Lectures for students. Chisinau. Artpoligraf. 182p. ISBN 978-9975-3487-3-7.
POTOPOVÁ, V., CASTRAVEȚ, T., CHAWDHERY, MD. R.A. 2022. Climate change, modelling, and adaptation measures. Lectures for students. Digital edition. Chisinau. Artpoligraf. 193p. (in press).
PIERREHUMBERT, R. T. 2012. *Principles of Planetary Climate*. Cambridge University Press, 250 pp. Cambridge UK. ISBN:9780521865562.
MCLLVEEN, R. 2010. Fundamentals of weather and climate. 625 pp. Oxford. ISBN-13: 978-0199215423.
ROHLI, R. V., & VEGA, A. J. (2017). Climatology. Jones & Bartlett Learning. 467p.
Food and Agriculture Organization of the United Nations 2021. The state of food security and nutrition in the world. Rome 2021.
FRANK, S., HAVLIK, et al. 2021. How much multilateralism do we need? Effectiveness of unilateral agricultural mitigation efforts in the global context. Environmental Research Letters 16 (10) e104038. DOI: 10.1088/1748-9326/ac2967.
HANS VAN MEIJL et. Al. 2020. Modelling alternative futures of global food security: Insights from FOODSECURE, Global Food Security, 25,100358
IPCC, 2021. Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change [MASSON-DELMOTTE, V., P. ZHAI, A. PIRANI, S.L. CONNORS, C. PÉAN, S. BERGER, N. CAUD, Y. CHEN, L. GOLDFARB, M.I. GOMIS, M. HUANG, K. LEITZELL, E. LONNOY, J.B.R. MATTHEWS, T.K. MAYCOCK, T. WATERFIELD, O. YELEKÇI, R. YU, AND B. ZHOU (EDS.)]. Cambridge University Press. (in press)
MICHIEL VAN DIJK et al. 2020. Stakeholder-designed scenarios for global food security assessments Global Food Security, 24, 100352.

Title of the study course	**Hydrogeology**				
Type of the study course	Elective			**Recommended study year / semester**	1/WS
Semester hours	24 lectures, 24 seminars	**hours**	48	**ECTS**	5
Type of students´ assessment	Credit, exam			**Study form**	Lectures, seminars
Description of study assessment and further requests	Credit – presence, reaching the requested score from written tests Exam – written + oral exam				
Guarantor of study course	prof. Ing. Svatopluk Matula, CSc.				
Involvement of guarantor in teaching	Lectures, consultations, examination				
Lecturer	prof. Ing. Svatopluk Matula, CSc. (100% lectures), Ing. Kamila Báťková, MSc., Ph.D. (100% seminars)				

Short content of lectures and seminars

Lectures:

- Theme 1 Introduction to hydrogeology, origin of ground water, rocks and ground water.
- Theme 2 Pores in rock and ground water, porosity, effective porosity, storage of water.
- Theme 3 Flow and flow rate in rocks, Darcy´s law, validity for rocks.
- Theme 4 Permeability, filtration coefficient and hydraulic conductivity of the rock, differences between them, determination.
- Theme 5 Transmissivity, ground water flow in hydrogeology, steady and unsteady flow into the wells.
- Theme 6 Theis and Jacob´s solution, well logging, pumping tests.
- Theme 7 Ground water in fractures, primary and secondary fractures.
- Theme 8 Ground water in cavities, karst, lava tubes, geology and ground water flow.
- Theme 9 Hydrogeological characteristics of the rocks, main groups of the rock and relation to ground water flow.
- Theme 10 HG characteristics of igneous rock and metamorphic rocks, HG characteristics of the sedimentary rock.
- Theme 11 HG structures and discharge of ground water, springs and their classification.
- Theme 12 Environmental applications of hydrogeology.

Seminars:

- Theme 1 Basic terms of hydrogeology, hydrologic cycle and hydrogeology.
- Theme 2 HG data in Europe and in the World, HG maps.
- Theme 3 Properties of porous media in HG.
- Theme 4 Darcy´s law and its application in HG.
- Theme 5 Flow in the rocks, transmissivity, hydraulic conductivity.
- Theme 6 Steady and unsteady flow, flow into the wells.
- Theme 7 Theis and Jacob´s solution, pumping tests and their evaluation (computer room SPS).
- Theme 8 Fractures.
- Theme 9 Karstic systems.
- Theme 10 HG characteristics of the rocks I.
- Theme 11 HG characteristics of the rocks II.
- Theme 12 Practical training, Groundwater source pollution.

Literature

DEMING, D. 2002. Introduction to Hydrogeology. McGraw Hill. p. 468. ISBN 0072326220.
MATULA, S. 2005. Hydrogeology for Natural Resources and Environment. Czech University of Agriculture in Prague. p. 139. ISBN 8021313102.
MATULA, S., BÁŤKOVÁ, K. 2021. Multimedial guide to water resources excursions. CZU Prague, ISBN 9788021330733.
BOULDING, J. R., GINN, J. S. 2004. Soil, Vadose Zone and Ground-water Contamination. Lewis Publishers. p. 691. ISBN 0566706106.
BRASSINGTON, R. 2007. Field Hydrogeology. John Wiley & Sons. Ltd. Third Edition. p. 264. ISBN0470018283.
FETTER, C. W. 2001. Applied Hydrogeology. Prentice Hall. USA. p. 598. ISBN0131226878.
SEN, Z. 1995. Applied Hydrogeology for Scientists and Engineers. CRC Press. USA. p. 444. ISBN 1566700914

Title of the study course	**Modelling in Soil Science**				
Type of the study course	Elective			**Recommended study year / semester**	1/WS
Semester hours	24 lectures, 24 seminars	**hours**	48	**ECTS**	5
Type of students´ assessment	Credit, exam			**Study form**	Lectures, seminars, projects
Description of study assessment and further requests	Credit – finished project Exam – written test				
Guarantor of study course	prof. Ing. Radka Kodešová, CSc.				
Involvement of guarantor in teaching	Lectures, seminars, consultations, examination				
Lecturer	prof. Ing. Radka Kodešová, CSc. (100%)				

Short content of lectures and seminars

Lectures:

- Introduction into the modeling in soil science: division of the models according to the theoretical background, scale.
- Pedogenetic models: generalized description of pedogenesis, classification of soil processes.
- Models of porous system (microscale): methods of investigation of the porous materials structure and models.
- Upscaling from microcsale to macroscale - practical application of the models of the porous system, capillary models.
- Models for the soil hydraulic properties prediction: regression, morphological, physically empirical models.
- Models describing transport of water in soil: basic equation, solution methods.
- Models describing transport of gas and heat in soil: basic equations.
- Models describing transport of dissolved substances in soil: conservative and non-conservative miscible flow.
- Models describing transport of immiscible phases: Definition and derivation of the soil hydraulic properties.
- Model calibration - inverse modeling: inverse-modeling definition, methods of verification, used methods.
- Upscaling from macroscale to larger scale - spatial and time variability, scaling factors.
- Models for water and solute transport assuming bi-modality of the soil porous system.

Seminars:

- Determination of soil hydraulic properties.
- Determination of the pore radii distribution function.
- RETC code application - description of the soil water retention curve.
- Capillary model application - prediction of unsaturated hydraulic conductivities from the soil water retention curve.
- ROSETTA code application - prediction of the soil hydraulic properties.
- Simulation of the water transport in the soil profile using the HYDRUS-1D code.
- Characteristics of solute transport.
- Simulation of the solute transport in the soil profile - conservative transport - using the HYDRUS-1D code.
- Simulation of the solute transport in the soil profile - non-conservative transport - using the HYDRUS-1D code.
- Application of the BPS code.
- Inverse modeling in the laboratory column using the HYDRUS-1D code.

Literature

KUTÍLEK, M., NIELSEN, D. R. 1994. Soil hydrology. Catena Verlag GMBH. Germany. ISBN 3-923381-26-3.
DANE, J. (eds). 2003. Methods of soil analysis, Part 4 - Physical methods. SSSA. Madison. USA. ISBN 0-89118-841-X.
Programy HYDRUS-1D, RETC, ROSETTA
ŠIMŮNEK, J., ŠEJNA, M., VAN GENUCHTEN, M. TH. 2005. The HYDRUS-1D. IGWMC-TPS-53. International Ground Water Modeling Center. Colorado.
SCHAAP, M. G., LEIJ, F. J., VAN GENUCHTEN, M. TH. 1999. A bootrstrap-neural network approach. University of California. Riverside. 1237-1250.
VAN GENUCHTEN M. TH., LEI F. J., YATES S. R. 1991. The RETC code. EPA/6000/2-91-065. US EPA.

Title of the study course	**Soil and Water Relationship**				
Type of the study course	Elective			**Recommended study year / semester**	1/SS
Semester hours	24 lectures, 24 seminars	**hours**	48	**ECTS**	5
Type of students´ assessment	Credit, exam			**Study form**	Lectures, seminars, terrain practice
Description of study assessment and further requests	Credit – presence, requested score from written tests Exam – score from written test and following oral exam				
Guarantor of study course	prof. Ing. Svatopluk Matula, CSc.				
Involvement of guarantor in teaching	Lectures, consultations, examination				
Lecturer	prof. Ing. Svatopluk Matula, CSc. (100% lectures) , Ing. Kamila Báťková, MSc., Ph.D. (100% seminars)				

Short content of lectures and seminars

Lectures:

- Theme 1 Soil and water relationship in general, porosity, soil water content
- Theme 2 Soil water content, definition, determination of soil water content I
- Theme 3 Determination of soil water content II - neutron probe method, gamma radiation method, remote sensing method
- Theme 4 Soil water atmosphere system, adsorption water, adsorption process
- Theme 5 Capillary water - capillarity, gravitational water
- Theme 5 Soil physical properties - water content relationship
- Theme 6 Soil water potential, concept and definition, components of the potential
- Theme 8 Relationship of the potential versus water content, tensiometer, measurements
- Theme 9 Soil water retention curve, hysteresis, analytical expressions of soil water relationship, hydrolimits
- Theme 10 Flow of water in soils, Darcy´s law, difference between permeability and saturated hydraulic conductivity
- Theme 11Saturated hydraulic conductivity, determination in the lab and in the field
- Theme 12 Unsaturated flow in soils, infiltration and other transport processes, transport of solutes in soils

Seminars:

- Theme 1 Introduction; Soil water content definition, calculation, mass and volume water content, water storage, soil bulk density, porosity (calculations)
- Theme 2 Determination of the soil particle density using water pycnometer method (laboratory)
- Theme 3 Methods for calibration of indirect methods to determine water content, soil moisture sensor calibration (laboratory)
- Theme 4 Soil moisture sensor calibration: Evaluation of the results from previous class using method of the least squares (computer room)
- Theme 5Adsorption isotherm: using Freundlich and Speransky equations for data fitting (computer room)
- Theme 6 Capillarity, capillary forces, binding of water in a capillary (easy lab experiment; calculations)
- Theme 7 Influence of moisture content changes upon soil physical properties: Determination of consistency limits (laboratory)
- Theme 8 Soil water potential: Total potential and component potentials, tensiometer (calculations)
- Theme 9 Test for credit; Retention curve: Practical presentation of devices for soil water potential measurement (in laboratory)
- Theme 10 Soil water retention curve and pF curve: using van Genuchten analytical equation for data fitting (computer room)
- Theme 11 Determination of the saturated hydraulic conductivity of soils in lab: Constant head and Falling head permeameter (calculations)
- Theme 12 Determination of soil unsaturated hydraulic conductivity using the Minidisk Infiltrometer

Literature

HILLEL, D. 1998. Environmental Soil Physics. Academic Press. San Diego. USA. p. 771. ISBN 0123485258.
KUTILEK, M., NIELSEN, D. R. 1994. Soil Hydrology. Catena Verlag. p. 370. ISBN 3923381263.
DIRKSEN, CH. 1999. Soil Physics Measurements. Catena Verlag. Germany. p. 154. ISBN 3923381433.
STEWART, B. A., HOWELL, T. A. 2003. Encyclopedia of Water Science. M. Dekker. New York. Basel. p. 1076. ISBN 0824709489.
MATULA, S., BÁŤKOVÁ, K. 2021. Multimedial guide to water resources excursions. CZU Prague, ISBN 9788021330733
BOULDING, J. R., GINN, J. S. 2004. Soil, Vadose Zone and Ground-water Contamination. Lewis Publishers. p. 691. ISBN 0566706106.
Dirksen, Ch. 1999. Soil Physics Measurements. Catena Verlag. Germany. p. 154. ISBN 3923381433.
www.moodle.czu.cz

Title of the study course	**Soil Taxonomy, Survey and GIS**				
Type of the study course	Elective			**Recommended study year / semester**	1/SS
Semester hours	24 lectures, 20 seminars, 4 terrain courses	**hours**	48	**ECTS**	5
Type of students´ assessment	Credit, exam			**Study form**	Lectures, terrain course (survey), seminars – samples analysis, work with computer, project
Description of study assessment and further requests	Credit – participance on terrain survey, finished project and its presentation Exam – written test				
Guarantor of study course	prof. Ing. Radka Kodešová, CSc.				
Involvement of guarantor in teaching	Lectures, terrain survey, examination, consultations				
Lecturer	prof. Ing. Radka Kodešová, CSc. (60% lectures + seminars), doc. Ing. Vít Penížek, Ph.D. (25% lectures + seminars), RNDr. Tereza Zádorová, Ph.D. (15% lectures + seminars)				

Short content of lectures and seminars

Lectures

- Objectives, subjects and approaches of soil classification, pedogenetic factors and processes.
- Diagnostic horizons and features, introduction to soil classification systems.
- International classification systems.
- Characteristics and management of the reference soil groups.
- Global distribution and geography of soils.
- Soil survey and mapping - principles, methods with respect to the scale.
- Soil survey with respect to the soil/water relationship.
- Application of geophysical methods for soil survey.
- Application of remote sensing for soil survey.
- Soil and terrain relationship.
- Soil cover heterogeneity - assessment (geostatistics, pedometrics).
- Interpretation of soil maps for different purposes (soil productivity rating, soil degradation and contamination).
- Principles of application of GIS soil survey and mapping.

Seminars:

- Description of morphological features.
- Delineation of soil diagnostic horizons, properties and materials.
- Classification of soil in World Reference Base.
- Classification of soils in Soil Taxonomy.
- Correlation of different soil classification systems.
- Setting individual projects - soil mapping within selected area.
- Field trip: soil profiles description in the field.
- Analytical data of soil profiles.
- Work in the computer laboratory - spatial interpretation of soil data.
- Work in the computer laboratory - delineated transects soil analysis.
- Hydropedological soil survey.
- Soil maps of different scales.
- Soil GIS - work in computer laboratory.
- Individual projects presentation; final discussion.

Literature

FAO 2015. World reference base for soil resources 2014, International soil classification system for naming soils and creating legends for soil maps, Update 2015.
Sine 1994. Keys to Soil Taxonomy. USDA. Soil Conservation Service. 306 p.
Sine 1998. World Reference Base for Soil Resources. FAO. Roma. 88 p. ISBN 92-5-104141-5.

NIELSEN, D. R., WENDROTH, O. 2003. Spatial and Temporal Statistics. Catena Verlag. Reiskirchen. ISBN 3-923381-46-8.
DRIESSEN, P., DECKERS, J., NACHTERGAELE, F. 2001. Lecture Notes on the Major Soils of the World. World Soil Resources Reports 94. FAO. Rome. ISBN 925-104637-9.
ISAAKS, E. H., SRIVASTAVA, R. M. 1990. An Introduction to Applied Geostatistics. Oxford University Press. New York. 561 p. ISBN 0-19-505013-4.
BURROUGH, P., MCDONNELL, A. 1998. Principles of Geographical Information Systems. Oxford University Press. New York. ISBN 0-19-823365-5.

Title of the study course	**World Economy and Agriculture**				
Type of the study course	Elective			**Recommended study year / semester**	1/WS
Semester hours	24 lectures, 12 seminars	**hours**	36	**ECTS**	5
Type of students´ assessment	Credit, exam			**Study form**	Lectures, seminars
Description of study assessment and further requests	The exam consists of two parts - written and oral. The written part concentrates on the theoretical and practical foundations of the subject. The oral part is devoted to discussions on selected topics related to the specific of world economy and related agricultural issues. Requirement pass: The entitlement to gain the credit arises after the participation of a specified number of seminars and also after the elaboration, presentation and discussion of projects related to international trade in agricultural trade issues.				
Guarantor of study course	prof. Ing. Luboš Smutka, Ph.D.				
Involvement of guarantor in teaching	Lectures, seminars, exams				
Lecturer	prof. Ing. Luboš Smutka, Ph.D. (100 %) *guest lecturer: prof. UPP dr hab. Wawrzyniec Czubak (Poznan University of Life Sciences)*				

Short content of lectures and seminars

Lectures:

- The state of world economy and the role of agriculture within the global economy.
- Global economy disparities.
- World population specifics and living standards development.
- Role of agriculture in coping global problems, agriculture from the historical perspective.
- The role of agriculture in economic development and structural transformation.
- The world food problem and undernutrition.
- Demographic determinants of food demand.
- Classification of world agricultural systems.
- Determinants of agricultural output.
- World agricultural commodity markets.
- World agricultural and food policies.
- World merchandise and agricultural trade.

Seminars:

- Case studies assignment and assignment for next seminar.
- The state of global and regional economy.
- The state of global and regional agriculture.
- GATT/WTO.
- World and regional trade in agri-food products.
- EU CAP.

Literature

SMUTKA, L., MACH, J., SELBY, R. et al. World agricultural production, consumption and trade development - selected problems. Praha powerprint. 2012. ISBN 978-80-87415-45-0.
ANDERSON, K. Agricultural Trade, Policy Reforms, and Global Food Security. Palgrave Macmillan US, 2016. ISBN: 978-1-137-47168-0.
CORBIN, L., PERRY, M. Free Trade Agreements. Springer Singapore, 2019. ISBN: 978-981-13-3037-7.
ACHARYYA, R., MARJIT, S. Trade, Globalization and Development. Springer, 2014. ISBN: 978-81-322-1150-1.
KRUGMAN,P. R., OBSTFELD, M. and MELITZ, M. International Trade: Theory and Policy, 11th Edition, Published by Pearson, 2017. ISBN-13: 978-0-13-451955-5
FAO. Food Outlook – Biannual Report on Global Food Markets. Rome, 2020. ISBN 978-92-5-132848-4
AKSOY, M. A., BEGHIN, C. J. Agricultural trade and developing countries. World Bank, 2005. ISBN 0-8213-5863-4
HITE, K. A., SEITZ, J. L. Global issues: anintroduction. Fifth edition. Malden, MA: Wiley-Blackwell, 2016. ISBN: 978-1-118-96885-7
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Title of the study course	**Landscape Ecology**				
Type of the study course	Elective			**Recommended study year / semester**	1/WS
Semester hours	24 lectures, 24 seminars	**hours**	48	**ECTS**	5
Type of students´ assessment	Credit, exam			**Study form**	Lectures, seminars
Description of study assessment and further requests	Credit: Presence, presentation of seminar work Exam: Oral				
Guarantor of study course	doc. Ing. Jan Skaloš, Ph.D.				
Involvement of guarantor in teaching	Lectures				
Lecturer	doc. Ing. Jan Skaloš, Ph.D. (100%)				

Short content of lectures and seminars

Lectures:

- Introduction to the study (practical information regarding the course, the definition and history of the field, background).
- Basic approaches, concepts and definitions in landscape ecology.
- Field trip – no lecture.
- Landscape Ecology as a science: history until now.
- Landscape function and structure (part 1).
- Landscape function and structure (part 2).
- Does the history of landscape matter? Concepts, approaches, lessons by case studies.
- Landscape classification.
- Ecological networks in the landscape.
- Using landscape ecology principles in landscape planning.
- Applications of key landscape ecological elements.
- Course recapitulation.

Seminars:

- Introduction to seminars.
- Data sources in landscape ecology.
- Field trip, no practical session.
- Using Czech Cadastral GIS Data.
- Territorial System of Ecological Stability.
- Presentation of readings by students.
- Presentation of readings by students.
- Presentation of readings by students.
- Presentation of readings by students.
- Presentation of readings by students.
- Presentation of readings by students.
- Presentation of readings by students.

Literature

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Title of the study course	**Human Resource Management**				
Type of the study course	Elective			**Recommended study year / semester**	1/SS
Semester hours	24 lectures, 12 seminars	**hours**	36	**ECTS**	5
Type of students´ assessment	Credit, exam			**Study form**	Lectures, seminars
Description of study assessment and further requests	Credit: attendance, presentations, individual and team tasks, case studies Exam: written and oral exam focused on theoretical knowledge and their application				
Guarantor of study course	doc. Ing. Martina Fejfarová, Ph.D.				
Involvement of guarantor in teaching	Lectures				
Lecturer	doc. Ing. Martina Fejfarová, Ph.D. (100%)				

Short content of lectures and seminars

Lectures:

- Human Resource Management in the 21st Century: Challenges for the Future.
- Labour Market.
- Recruitment and Selection – Part I.
- Recruitment and Selection – Part II.
- New Employee Adaptation.
- Motivation and Employee Engagement.
- Reward Management.
- Performance Management.
- Training and Development.
- Career Management.
- Employee Mobility.
- Human Resource Management Perspectives.

Seminars:

- Human Resource Management – Introduction, Case study, TED Talk.
- MBTI test, Case Study, TED Talk.
- Cover Letter, Case Study, TED Talk.
- CV, Case Study, TED Talk.
- Job Interview, Case Study, TED Talk.
- Coaching, Case Study, TED Talk.

Literature

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Title of the study course	**Rural Development**				
Type of the study course	Elective			**Recommended study year / semester**	1/SS
Semester hours	24 lectures, 12 seminars	**hours**	36	**ECTS**	5
Type of students´ assessment	Seminar tasks, credit, exam			**Study form**	Lectures, seminars
Description of study assessment and further requests	Seminar tasks have either group or individual content. Students can obtain additional points for the exam on the basis of a well-developed and presented task (assigned during the seminar and focused on the discussed issues). Credit is awarded on the basis of the project (the minimum score is 12 points out of 20 possible; the assessment monitors the extent and how the knowledge of the subject is used in the project). The exam is in written form. During the exam, students answer 10 questions in the form of a multiple choice test (max. 20 points) and 5 questions (max. 30 points) answer in the form of verbal answers, when a list of these questions is available to students in advance.				
Guarantor of study course	prof. PhDr. Michal Lošťák, Ph.D.				
Involvement of guarantor in teaching	Lectures, seminars, examination				
Lecturer	prof. PhDr. Michal Lošťák, Ph.D. (100%)				
Short content of lectures and seminars					

Lectures:

- Social sciences and their role in rural development.
- Defining countryside (what is “rural”). Rural typologies.
- The countryside and time. Social change. Sustainability. UN Sustainable Development Goals
- Modernization, innovation and retro-innovations in rural development (the case of food).
- Economics and its theories applied in rural development.
- Sociology and its theories applied in rural development.
- Invisible/intangible forms of capital (human capital, social capital) and their use in rural development. Rural empowerment.
- Concepts of rural-urban relations and their projections into rural development.
- Social problems in rural areas and explanation of their origin using theories of sociology and economics.
- Model of exogenous rural development.
- Model of integrated rural development. Community led local development (participation of rural population).
- Impacts of globalization on the countryside and agriculture.

Tutorials/Seminars:

The seminars are highly interactive. The students work every seminar with a practical case. They are required to address the case under the guidance of the teacher. They either form the groups or work individually upon the case. Their results are presented to the class and their colleagues’ comments (together with the teacher) the outcome of the work. The students evaluate the pitfalls in selected project of the Czech development aid; they prepare short video about what they did not mentioned in the countryside earlier in the course and compare Czech countryside with countryside in their own country (using the video they developed); they demonstrate the role of food in rural development; they construct the sustainable visions of the countryside, using videos with concrete cases they suggest development projects.

Literature

All basic needed study materials and study support is available to the students via Moodle Learning Management System. The students also use contact hours with the teacher to get materials they need and to consult their work. These materials are tailored to the need of the students – therefore they are of individual nature.
VAN ASSCHE, K., HORNIDGE, A. K. 2015. Rural Development (Knowledge and expertise in Governance). Wageningen. Wageningen Academic Publishers.
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ROGERS, P., JALAL, K., BOYD, J. 2008. An Introduction to Sustainable Development. London: Glen Educational Foundation, Inc.

Title of the study course	**Landscaping**					
Type of the study course	Elective			**Recommended study year / semester**		1/SS
Semester hours	24 lectures, 24 seminars	**hours**	48	**ECTS**	5	
Type of students´ assessment	Credit, exam			**Study form**	Lectures, seminars, excursions	
Description of study assessment and further requests	Credit: seminar work – authors book (A3) Exam: discussion of the authors book					
Guarantor of study course	doc. Ing. Matouš Jebavý, Ph.D.					
Involvement of guarantor in teaching	Lectures, seminars, exams, consultations					
Lecturer	doc. Ing. Matouš Jebavý, Ph.D. (100%)					

Short content of lectures and seminars

Lectures:

- The man and the seat and the man and the landscape, relationship of the man, green and residential value of the seat.
- The historical evolution of public green areas and landscape.
- The Types of seat green. ČSN 839001, the seat green systems, the functions of the seat green systems (city green systems).
- The green in urban planning and landscape planning, the levels of urban and landscape planning.
- Basic design forms of green in the seat and in the landscape, design contents standards.
- The landscape of the city, the green of the city public areas, typology, space composition, traffic analysis, influence.
- The green of the city public areas, the green in the landscape, typology, space composition, traffic analysis, influence.
- The city park, park areas, history of the rise, basic functions, park conceptions, the role of the park.
- Spa parks, Spa towns, historical parks and landscape parks.
- The landscape of the residential areas, Le Corbusier, functional zones of the city, space conception, space reconstruction.
- The landscape areas between houses, children playgrounds, advantages and disadvantages, microclimate conditions, the landscape around seats, design of the cultural landscape.

Seminars:

- Regulations and norms, profession co-operation.
- Basis materials for the design of seat green and garden design.
- Practical analysis of the contents and forms of the different types of design documentation.
- Practical analysis of the contents and forms of the different types of design documentation.
- Process of the study of choosed formation of seat green or family garden.
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- Process of the study of choosed formation of seat green or family garden.
- Process of the study of choosed formation of seat green or family garden.
- Process of the complete design of choosed formation of seat green or family garden.
- Process of the complete design of choosed formation of seat green or family garden.
- Assessment.

Literature

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