COURSES FOR EXCHANGE STUDENTS

offered in English or in German language
in the academic year 2016/2017

COURSE CONTENTS

Name of the Course: Human nutrition		**Code:** GET00C24K27
Lecturer: Dr. Károly Dublecz	**Semester:** winter / summer	
Lessons: 28 hours oral lectures	**Grading and Evaluation:** oral exam	**Credit:** 4

Aim of the course:
The aim of this subject is to offer a comprehensive guide to nutrition, diet and food for the students. The importance of diet and nutrition in the maintenance of health is universally known and recognised. In the recovery from illness and injury diet plays also a crucial role.
The subject summarizes the present knowledge of human nutrition and supplies information about food to enable nutritional knowledge to be translated into specific and practical advice.
The subject aims to promote understanding of the main concepts of nutrition so that dietary advice can be based on sound principles and applied with common sense.

Course program:

- basic terms and concepts
- life expectancies
- digestion, absorption and metabolism
- nutrient requirements
- evaluation of nutritional status
- carbohydrates
- energy metabolism
- proteins, vegetarianism
- fats
- vitamins
- minerals
- diet and health

Suggested Literature:
Brenda Piper (1996): Diet and nutrition, Chapman & Hall, London
Garrow, J.S., James, W.P.T. (1993) Human nutrition and dietetics, Churchill Livingston, Edinburgh
Bender, D. A.: Introduction to Nutrition and Metabolism. UCL Press Limited, London, 1993.

Name of the Course: Animal nutrition		**Code:** KEGNAAM144C
Lecturer: Dr. Károly Dublecz	**Semester:** winter / summer	
Lessons: 28 hours oral lectures	**Grading and Evaluation:** oral exam	**Credit:** 4

Aim of the course:
In the frame of the course all the basic and applied information on animal nutrition are thought, which plays as the basis of the further studies on animal husbandry. The course makes the student also capable to understand nutrient requirements of farm animals, the nutrient content of the most common feedstuffs and to prepare compound foods and daily rations.

Course program:

- Chemical composition of feedstuffs (water, dry matter, protein, fats, fibre, nitrogen –free extract, minerals, vitamins, other bioactive substances)
- Digestion characteristics of different farm animal species (ruminants, pigs, horses, rabbits, poultry, dogs, cats)
- Measurement of the nutritive value of feeds
- The effects of nutrition on the production of different animal products (maintenance, growth and meat production, wool production, reproduction, milk production, egg production,
- Characteristics of the most important feedstuffs (pasture, green and leafy feeds, roots and tubers, hays and straws, grains, industry by-products, feed additives)
- Feed conservation (fermentation, drying)
- Feed manufacture and trade

Suggested Literature:
McDonald, P., R.A. Edwards, Greenhalgh, J.F.D. (1988): Animal nutrition, Longman Scientific and Technical
Greenhalgh, F.F.D.; C A Morgan, R. A. Edwards, P. McDonald (2002): Animal nutrition, Pearson Education
Kellems, R.; D. Church (2010): Livestock Feeds and Feeding, Pearson Education,

Name of the Course: Physiology of Animal Production		**Code:** KEGNAAB144F
Lecturer: Dr. Ferenc Husveth	**Semester:** winter	
Lessons: 2+1	**Grading and Evaluation:** oral examination	**Credit:** 4

Aim of the Course:

The goal of this subject is to provide an upper level course for agricultural students to get a deeper knowledge in the physiological and biochemical processes for animal production. This course also includes sufficient system, organ and tissue anatomy to enable students to better appreciate the integration of both the structure and function.

Course Program:

- Neuroendocrine adaptation of domestic animals
- Digestion physiology of domestic animals
  -Digestion of monogastric animals (pig and horse)
  -Digestion of poultry
  -Ruminant digestion
- Carbohydrate, protein, lipid absorption and metabolism in animals
- Physiology and manipulation of growth in young animals; meat production
- Physiology of egg production
- Physiology of lactation
- Equine exercise physiology

Suggested Literature:

- Husveth F. (2009): Physiology of Animal Production, MSc Defree Programs in Agriculture, Univ. Debrecen, Western Hungary and Pannonia
- Akers R. M. and D. M. Denbow (2008): Anatomy and Physiology of Domestic Animals, Blackwell Publishing, Iowa – Oxford -Victoria

Name of the Course: Mammalian reproduction		**Code:** KEGNAAM112B
Lecturer: Dr. Szabolcs Nagy, professor	**Semester:** winter / summer	
Lessons: 13	**Grading and Evaluation:** oral exam	**Credit:** 2

Aim of the Course:

The aim of the subject is to make the students acquainted with the biology of mammalian farm animals and the methods of animal breeding and production.

Course Program:

1. gametes, fertilization, embryogenesis
2. female reproductive system
3. male reproductive system
4. pituitary and hypothalamus
5. reproductive behavior of the male and female
6. reproductive processes, puberty, seasonality, ovarian cycle
7. pregnancy, parturition
8. lactation
9. cattle
10. sheep and goats
11. pigs
12. horses
13. assisted reproductive technologies

Suggested Literature:

M.H. Johnson: Essential Reproduction. 7th ed., Wiley, 2013.

Name of the Course: Fish Culture		**Code:** KEGNAAM143F
Lecturer: Dr. Miklós BERCSENYI and Gábor BELICZKY	**Semester:** summer (spring)	
Lessons: 14 x 45 min. theory 14 x 45 min. practice	**Evaluation:** based on a practical task and colloquium	**Credit:** 3

Aim of the Course: to teach the students on the basics of fish culture by presenting the history, the main species, the tendencies, the methods of profitable and responsible fish culture

Course Program:

- Tendencies and their reasons in word's capture fisheries and aquaculture.
- The most important fish species raised in aquaculture
- Fishes and their environment (basic hydrobiology of fish ponds)
- Fish culture strategies: (extensive and intensive pond culture, cage and tank culture with through-flow or water recirculation.
- Artificial propagation of trout, sturgeons, pike, cyprinids and some selected percids and catfishes.
- Technology of fry nursing (Preparation of ponds, stocking densities, feeding, harvest at size of 2-3 cm fish.
- Monoculture or polyculture of table size fish. Growth at temperate or tropical climate. The effect of stocking density, feed ratio and type of feeding on growth (SGR), survival and feed conversion (FCR)
- Basics of culture systems with water recirculation
- Introduction in fish parasitology and approved treatment methods
- Live fish transportation.

Suggested Literature:

The State of World Fisheries and Aquaculture. http://www.fao.org/3/a-i3720e.pdf
Cultured Aquatic species. http://www.fao.org/fishery/culturedspecies/search/en
Claude E. Boyd, C.S. Tucker: Pond Aquaculture Water Quality Management, Springer Science & Business Media, 1998
PPT material to be presented to the students of the course

Name of the Course: Economics of Farm Enterprises I.		**Code:** MNGT001K101
Lecturer: Ferenc Zemankovics, Dr. Zsuzsanna Bacsi	**Semester:** winter	
Lessons: 2+0	**Grading and Evaluation:** C (Term-end examination)	**Credit:** 2

Aim of the Course:

To understand the basic concepts and tools of managing farm enterprises. Learn the basic skills required to assess farm performance.

Course Program:

- Definition of farm enterprises and farm management
- Farm resources, assets and liabilities, balance sheet, net worth
- Variable and fixed costs, depreciation, gross margin analysis, profitability
- Analysis of constraints and potentials, farm performance
- Developing a farm plan, marketing, value-added activities
- Enterprise budgeting, break-even analysis, partial budgeting
- Whole farm planning and budgeting
- Cash-flow analysis, capital investments
- Discounted investment appraisal (NPV, IRR...)
- Risk management, sensitivity analysis

Suggested Literature:

- Bacsi, Zs (2015): Economics of Farm Enterprises. University of Pannonia, Veszprém
- FAO (2007): Market-Oriented Farm Management for Trainers of Extension Workers – Africa. Training Materials for Agricultural Management, Marketing and Finance 6. FAO, Rome
- Olson, Kent D (2004): Farm Management: Principles and Strategies. Iowa State Press, Ames, Iowa
- Olson, Kent D (2011): Economics of Farm Management in a Global Setting, John Wiley&Sons, Hoboken

Name of the Course: Economics of Farm Enterprises II.		**Code:** MNGTN02K150
Lecturer: Ferenc Zemankovics, Dr. Zsuzsanna Bacsi	**Semester**: summer	
Lessons: 1+2	**Grading and Evaluation:** C (Term-end examination)	**Credit:** 3

Aim of the Course:

To understand and learn the tools and methods to be used in financial farm management, for enterprise level and whole-farm level planning.

Course Program:

- Definitions and Functions of Management
- Farm records, Farm Accounting
- Balance sheet, Cash Flow, Net Farm Income – Concepts and General Explanation
- Farm Business Analysis (Balance Sheet Analysis)
- Costs of Production in Farming
- Enterprise Budgeting and Whole Farm Planning
- Partial Budgeting, Cash-Flow Budgeting
- Basic Elements of Enterprise Analysis
- Capital, Credit, and Land Use
- Investments and Machinery
- Human Resources and Labour
- Future of Farm Management.

Suggested Literature:

- Bacsi, Zs (2015): Economics of Farm Enterprises. University of Pannonia, Veszprém
- Barnard, Nix: Farm Planning and Control. Cambridge University Press, 1998.
- Buckett, M: An introduction to Farm Organisation and Management. Pergamon Press, 1988.
- Kay, R – Edwards, W M - Duffy P.A (2007): Farm Management . Publisher: McGraw-Hill Higher Education; 6 edition
- Olson, Kent D (2011): Economics of Farm Management in a Global Setting, John Wiley&Sons, Hoboken

Name of the Course: Destination Management		**Code:** KEGNGTB213D
Lecturer: Ferenc Zemankovics, Dr. Zsuzsanna Bacsi	**Semester:** summer	
Lessons: 2+0	**Grading and Evaluation:** C (Term-end examination)	**Credit:** 3

Aim of the Course:

The objective is to give an overview in English about the concept and aims of tourism destination management, its organisational and functional components; the main issues of destination management organisations and their operation, the Hungarian and international experiences. Another objective is for the students to learn about the activities and tasks carried out during the management of tourism destinations.

Course Program:

- Key concepts, definitions and approaches in destination management
- The destination life cycle theory.
- The functions and roles of various actors, stakeholders
- The role of the government, municipalities
- The role of tourism information bureaus and business partners
- Cooperation in tourism destinations. Power hierarchies.
- Tourism destination management organisations, models, the tourism DM model in Hungary
- Tourism destination planning,
- Development of destination marketing strategy.
- Impacts of tourism on the destination, coping with the impacts
- Attraction management.
- Information management
- International and national case studies
- .Summary

Suggested Literature:

- Morgan, N- Pritchard, A- Pride, R (eds, 2002): Destination Branding:Creating the Unique Destination Proposition. Elsevier, Amsterdam-New York - Tokyo Papatheodorou, A. (2006): Managing Tourism Destinations, E. Elgar Publishing
- Pike, Steven (2008): Destination Marketing. An Integrated Marketing Communication Approach. Elsevier – Butterworth Heinemann; Amsterdam-Boston-Heidelberg-New York.
- Ritchie, J. R. B. and Crouch G. I (2003): The Competitive Destination – A Sustainable Tourism Perspective. CABI Publishing, Oxford.
- Bacsi (ed., 2014): Destination Management in Health Tourism. University of Pannonia, Keszthely.

Name of the Course: Transport and Tourism		**Code:** KEGNGTB113A
Lecturer: Ferenc Zemankovics, Dr. Zsuzsanna Bacsi	**Semester:** winter	
Lessons: 2+0	**Grading and Evaluation:** C (Term-end examination)	**Credit:** 3

Aim of the Course:

The module aims to examine the linkages between transport and tourism, looking at the history of transport usage in tourism, the technological determinants and the modes of transport used for tourism. The course will look at the characteristics of transport in various tourism regions as well as the volume of tourism with regards to the various modes of transport, and assess the relevant trends influencing the transport options used in and for tourism.

Course Program:

- Scientific results on tourism and transport. The crucial role of transportation and the development of touristic destinations. Transportation systems and networks, spatial structures.
- Approaches and problems of transport and tourism. Globalisation, marketing, management and transport. The role of government policy. Towards the EU common transportation policy.
- The analysis of touristic transport demand: motivation, psychological aspects of travelling. Forecast of potential travel demands, possible scenarios.
- The analysis of touristic transport supply: competitiveness, supply chain in touristic travelling sector. Analysis of transactions, integration in tourism.
- The management of transport supply: business strategies, cooperation and the role of IT in logistics and transport.
- Transport and geography. Mid-term written test paper.
- International and national case studies – theoretical and practical experiences.
- Chosen and supervised topics of case studies – student presentations.
- The management of air transport and its infrastructural aspects. The role of airports, performance indicators, marketing, discount airlines. Global terrorism and the impacts of security regulations.
- The human and environmental impacts of transport and tourism. Sustainable transport in tourism. Experiences of different destinations.
- Global challenges of tourism and transport. Impacts of climate change and energy utilisation. New forms of tourism.
- Global, national and local perspectives and issues. Challenges of globalisation and the quality of the services.
- Transport and visitors in historical cities.
- Cruising, non-motorised transport and tourism.

Suggested Literature:

- Page, Stephen J. (2009): Transport and Tourism - Global Perspectives. Pearson Education Ltd. Edinburgh Gate, Harrow, Essex, England.
- Lumsdon, L. – Page, S. J. (2004): Tourism and Transport- Issues and Agenda for the New Millenium. Elsevier, Amsterdam – New York – Oxford.
- Rodrigue, J. P. – Comtois, C. – Slack, B. (2006): The Geography of Transport Systems. Routledge, Abingdon – New York.
- Duval, D. T. (2007) Tourism and Transport: Modes, Networks and Flows. Clevedon, Channel View Publications

Name of the Course: Trade and Marketing		**Code:** MNGT001G001
Lecturer: Dr. Zsuzsanna Bacsi	**Semester:** winter	
Lessons: 2+1	**Grading and Evaluation:** F (Continuous assessment during the term)	**Credit:** 3

Aim of the Course:

The objective of the course is to help the students to understand the role of trade in the economy of a country, the importance of marketing in trade and commerce, the current trends in world trade and marketing. The students learn about the current strategies and tools used in trade and marketing.

Course Program:

1. Introduction to trade and marketing. The role of trade in the economy.
2. The concepts of marketing, basic terms. The role and value of marketing for consumers, firms and the society.
3. Understanding the market. Types of markets: consumer markets, industrial markets, institutional markets, reseller markets. The undifferentiated market, product differentiation, market segmentation, positioning.
4. The marketing mix: Product, Place, Price and Promotion.
5. Behavioural dimensions of the consumer. The consumer decision process.
6. Product planning, classification of products: consumer goods, industrial goods, services-
7. Price strategies, pricing flexibility, discounts, allowances.
8. The development of distribution channels. Wholesaling, retailing, physical distribution, customer service and logistics. Forms of retail trade. Retail chains, franchise systems, trademarks and brands.
9. Marketing communications. Advertising, sales promotion, public relations, personal selling.
10. External factors affecting the market: surprises, competitors, legal, ethical, economic, political, technological and social factors.
11. The concepts of trade, its role. History of trade. International trade and domestic trade.
12. The key features of international trade. The institutions and principles of trade policy. The WTO and the EU. INCOTERMS.
13. Multinational trade chains. Current issues and trends in world trade and marketing

Suggested Literature:

- Briones, Roehlano M. – Rakotoarisoa, Manitra A. (2013): Investigating the Structures of Agricultural Trade Industry in Developing Countries. FAO. www.fao.org
- Burnett, John (2008): Core Concepts of Marketing. Global Text Project , Zurich, Switzerland
- Dent, Julian (2008): Distribution Channels - Understanding and Managing Channels to Market. Kogan Page Limited. London-Philadelphia
- Love, P – Lattimore, R (2009): International Trade. Free, Fair and Open? OECD Publishing.
- Perreault, W. D. – McCarthy, E.J (2002): Basic Marketing. McGraw-Hill, Boston-New York-Toronto
- Stiglitz, J.E- Charlton, A (2005): Fair Trade for All. How Trade Can Promote Development. Oxford University Press, Oxford – New York.

Name of the Course: Common agricultural and rural policy in the EU		**Code:** MNGTM02K115
Lecturer: Dr. Gabriella Bánhegyi	**Semester:** winter and/or summer	
Lessons: 2+0	**Grading and Evaluation:** F (Continuous assessment during the term)	**Credit:** 2

Aim of the Course:

The objective of the course is to help students to understand the role and operation of the agricultural and rural policy in the European Union.

Course Program:

14. The short history of the European integration.
15. The institutions of the European Union
16. EU decision making process, EU legislation, different competences.
17. The changing role of agriculture in the EU, goals, instruments and principles of the early CAP
18. The price support mechanism and its consequences.
19. CAP benefits and shortcomings – evaluation of the first CAP period.
20. The reforms of the CAP, introducing and strengthening the second pillar (RD) – from CAP to CARPE
21. The cost of maintaining a common agricultural policy – the budget relations of agriculture and rural development.
22. Direct payments, SAPS and SPS
23. Greening the CAP? Obligatory measures toward a sustainable agricultural production.
24. Rural development – goals and instruments for maintaining viable rural communities.
25. Evaluation of the present policy framework. Renationalization prospects.
26. Let's compare – the CAP (CARPE) and the agricultural policies of some selected countries.

Suggested Literature:

- Hill, Berkeley (2012): Understanding the Common Agricultural Policy, Earthscan, London and New York, ISBN: 978-1-84407-778-6, p. 335
- Swinnen, Johann (2015): The Political Economy of the 2014-2020 Common Agricultural Policy: An Imperfect Storm, Centre for Eurpoean Policy Studies, Brussels, Rowman & Littlefield International Ltd., (free digital edition available at: https://www.ceps.eu/system/files/Political%20Economy%20of%20the%20CAP_Final_small.pdf)
- Tangermann, Stefan – von Cramon-Taubadel, Stephan (2013): Agricultural Policy in the European Union, Universitat Göttingen, Department für Agrarökonomie und Rurale Entwicklung. (free digital version available)

Name of the Course: Principles of Crop Improvement		**Code:** KEGNNBB314A
Lecturer: Dr. Zoltán Alföldi	**Semester:** **winter / summer**	
Lessons: lectures	**Grading & Evaluation:** oral, 1-5	**Credit:** 2

Aim of the Course: Crop cultivar improvement is of great importance for feeding the human population continuously growing. Recent plant breeding techniques require synthetized knowledge of several disciplines contributing to the success of breeder's work. That is why plant breeding is often called as a shared field of art and science. For these the aim of the course is to give students both broad-scale and detailed information on the present situation and future perspectives of cultivar development, teaching novel and broadly used techniques using for various crop development programs and how to combine them, utilizing plant genetic resources, and using computational resources in the work of plant breeders. The course also opens good opportunity for international students to learn at Georgikon Faculty and broaden the possibility of future international cooperations.

Course Program:

1. INTRODUCTION (plant breeding and its role in agriculture, disciplines that contribute to cultivar development, skills required for plant breeders. Definitions.). History of plant breeding.
2. GENETIC PRINCIPLES and POPULATION STRUCTURE (qualitative & quantitative genetics in breeding, heritability, inbreeding)
3. ORIGINS and CHARACTERISTICS of FIELD CROPS (gene centres)
4. GENETIC DIVERSITY (gene pools, plant genetic resources, gene banks)
5. CHROMOSOME MANIPULATION and POLYPOIDY
6. REPRODUCTION BIOLOGY of FIELD CROPS AFFECTING BREEDING TECHNIQUES (incompatibility, male sterility, apomixis)
7. FIELD PLOT TECHNIQUES
8. SELECTION STRATEGIES (*in vivo* and *in vitro* selection methods)
9. COMBINATION STRATEGIES (Crossing methods)
10. HYBRIDIZATION STRATEGIES (artificial hybridization, sexual & somatic hybridization)
11. MICROPROPAGATION, SOMATIC EMBRYOGENESIS, PRODUCTION & USE of HAPLOIDS
12. THE SCOPE of BIOTECHNOLOGY, BASIC TECHNIQUES
13. MARKER ASSISTED SELECTION
14. GENETIC MODIFICATION TECHNOLOGIES in PLANT BREEDING

Suggested Literature:

Poehlman (1987). Breeding Field Crops. 3rd ed. Van Nostrand Reinhold.

Fehr (1986). Principles of Cultivar Development. Vol.1. Theory and Techniques.

Relevant papers and printed materials supplied during the course by the instructor.

Name of the Course: Risk Assessment of Genetically Modified (GM) Crops		**Code:** KEGNNBM242D
Lecturer: Dr. Zoltán Alföldi	**Semester: <u>winter</u> / summer**	
Lessons: lectures + seminars	**Grading & Evaluation:** oral, 1-5	**Credit:** 2

Aim of the Course: The advantage of genetic modification in plant breeding is that a wider range of traits than is possible with conventional breeding can be introduced more quickly and directly into valuable germplasms. Genetic engineering of food and feed crops and foods deriving from them are, however, are considered as very controversial by the significant part of the public worldwide. On the one hand, the continuous increase of genetically modified (GM) crops in terms of area during their 20 years of commercial history can be considered as a great success. The main arguments of GM supporters are improved food security and food quality, and extended shelf-life, so they believe that GM crops will benefit not only farmers and consumers, but also the environment. The GM technology could allow saving on inputs of chemicals and labor. However, public acceptance of genetic engineering technology as applied to agriculture, and especially GM foods, depending on many factors, lags behind. Currently, the development of GM crop varieties has raised a wide range of legal, ethical, health and economic questions in agriculture. The debate on GM is therefore very much polarized, and the real benefits of today's biotechnology products are not evident to consumers and to the public.

Course Program:

1. Introduction to genetic modification in plants, fundaments, development, and current situation.
2. **Environmental risks I.:** effects of GM crops on biodiversity, evolution of resistance
3. **Environmental risks II.:** Vertical and horizontal gene transfer
4. **Environmental risks III.:** Impacts on non-target organisms
5. **Environmental benefits I.:** Reduced pesticide use and toxicity
6. **Environmental benefits II.:** Reduced tillage, erosion, carbon loss and water savings
7. **Environmental benefits III.:** GM crops in the era of climate change.
8. **Social risks and benefits** (bio-colonialism).
9. **Economical risks and benefits**.
10. **Principles of risk assessment.** Assessment of unexpected effects of GM crops.
11. **Risk-assessment** processes and methods of **risk management**
12. Implications for **monitoring.** Post-market environmental monitoring.
13. **Risk communication**.
14. The current **environmental regulatory processes** in the USA, Europe, and Hungary.

Suggested Literature:

Alfoldi, Z. 2011. Genetic modification and ethical considerations in plant breeding. University of Pannonia, Institute of English and American Studies, Vol. 1, Series I: America Week (to be provided).

Ervin, D.E. and R. Welsh, 2006. Environmental effects of genetically modified crops: differentiated risk assessment and management. In: Ervin, D.E. and R. Welsh (Eds.) Regulating Agricultural Biotechnology: Economics and Policy. Natural Resource Management and Policy, Vol.30, Part II, Section II.2, 301-326. Available online: http://library.wur.nl/frontis/transgenic_crops/02a_ervin.pdf

van den Brink, L., C.B. Bus, A.C. Franke, J.A.M. Groten, L.A.P. Lotz, R.D. Timmer, and C.C.M. van de Wiel. 2010. Inventory of observed unexpected environmental effects of genetically modified crops. DLO-ARS, Wageningen, The Netherlands (to be provided).

Name of the Course: Plant physiology and biotechnology		**Code:** KEGNNBM144A
Lecturer: Dr. Péter Szeglet, Dr. János Taller	**Semester:** winter	
Lessons: 2+2	**Grading and Evaluation:** oral exam	**Credit:** 4

Aim of the Course:
The course will provide information on the biochemical cycles of plant cell, photosynthesis, respiration, water management and nutrient assimilation bio regulations, growth and differentiation.
Further, the course will provide information about the structure, organization and function of the plant genome, about basic molecular analyzing methods, molecular markers and genetic modifications, as well as on plant tissue culture.

Course Program:
1. Photosynthesis
2. Respiration
3. Water management
4. Nutrient uptake and accumulation
5. Plant hormones, bioregulation
6. The sterile technology
7. Factors affecting growth and morphogenesis
8. In vitro plant culture techniques,
9. Micropropagation
10. Controlling persistent contaminants and plant diseases

Program schedule of the biotechnology module:
1. The plant genome
2. Basic molecular analyzing methods
3. Molecular markers
4. Genetic modifications
5. Plant tissue culture

Program of Laboratory practices and/or exercises
1. Examination of living capability of plant cells - plasmolysis
2. Identification of photosynthetical active pigments, paper chromatography
3. Measuring the concentration of chlorophyll by spectrophotometer
4. WE (ZH) – theoretical material
5. Growth physiology – using Auxin in rooting, rooting technologies; the polar transport of Auxin; the effect of CCC.
6. DNA extraction
7. Polymerase chain reaction, electrophoresis and gel-documentation
8. Molecular cloning
9. Plant tissue culture

Suggested Literature:
Plant Physiology - Lincoln Taiz Eduardo Zeiger - Sinauer Associates Inc (2006)
Experiments in Plant Physiology – Carol Reiss – Addison-Wesley (1994)
Physiology and Behaviour of Plants – Peter Scott – John Wiley and Sons Inc (2008)
Plant Propagation by Tissue Culture – Edwin F. George – Exegenetics Limited (1993)

Journals: Plant physiology
Plant Cell, Tissue and Organ Culture

Name of the Course: Ecology		**Code:**
Lecturer: Dr. Péter Szeglet	**Semester:** summer	
Lessons:	**Grading and Evaluation:** oral examination	**Credit:** 2

Aim of the Course:

The main purpose of this study to let the students know with the history of the ecology, with the essential ecological theories, with the ecological analysing methods. It deals with the examination of spreading and frequency of the living beings, with the interactions determining biological organisation. It provides ecological view for solving environmental- and nature conservation problems.

Course Program:

1. Ecological method and approach. Quantifying and system theory.
2. Population control mechanism, population dynamic. Stochasticaticism, determinism, feedback mechanisms.
3. Ecological environment; topographical and topological space; niche, source utilisation and niche-dimensions; niche overlapping and niche segregation.
4. Caching of energy and nutrient, utilising of the sources. Minimum theorem of Liebig; Shelford tolerance theorem.
5. Typical interactions between populations. Surviving- and fertility programs. Gradation, invasion, epidemic, pandemic.
6. Genetic identity and the evolution; pre adaptation, adaptation; domestication; genetic erosion; importance and destiny of the little populations.
7. Co adaptations- and co evolutions systems. Long term stability of population. Fitness and the evolutionary stable strategy.
8. Basis of production-biology. Growing-, development patterns; modularity; life strategies; surviving strategies (C, S, R).
9. Growth analysis, Growth characteristics, functions. Efficiency, material flow, biological half-life.
10. Primary and secondary production. The trophic level, and trophic structure of the ecosystem.
11. Association structure, and dynamic. Functioning-, structural-, and textural units of the Associations. Species richness and the diversity. Practical use of the diversity.
12. Species – territory relation, species balance theory, island biogeography. Factors determining stocking. Spreading areas, growing, and breeding areas.
13. Stability in space and time, the structure of the ecotops. Succession, climax. Disturbance, degradation, refugees.
14. Artificial regulation of the environment factors. Built environment, and the effect of environment pollution.
    Nature conservation, rehabilitation of damaged ecosystems.

Suggested Literature:

Dr. James Danoff-Burg: Introduction to Ecology I.
Institute Of Distance And Open Learning, University Of Mumbai: Basic Concepts Nature, Ecology, Environment
Turcsányi, G. szerk. (1995): Mezőgazdasági növénytan (Növényökológia fejezet). Mezőgazdasági szaktudás kiadó Budapest

Name of the Course: Mushroom knowledge		**Code:**
Lecturer: Dr. Péter Szeglet	**Semester:** summer	
Lessons:	**Grading and Evaluation:** oral examination	**Credit:** 2

Aim of the Course:

The main purpose of this study to let the students know with the most important edible, and poisonous mushrooms one can find nearby. They study the morphology, histology, ecotop, producing time and they study the mushroom poisoning types.

Course Program:

1. The role of the mushrooms in the nature, type of the nutrition.
2. Morphology, histology of mushroom, construction of a mushroom cell, the plectenhym, development types.
3. Morphological feature of mushrooms, types of fruiting bodies.
4. Function of the spore, its origin, structure.
5. Physiology and ecology of mushroom.
6. Mushroom poisoning: types, care of the poisoned, avoiding poisoning.
7. Systematic of fungus: Pesisaceae, Morchellaceae, Helvellaceae.
8. Tuberaceae, Cantharellaceae, Clavariaceae.
9. Sparassidaceae, Hydnaceae, Coriolaceae, Plyporaceae.
10. Boletaceae, Paxillaceae, Gomphidiaceae, Pleurotaceae, Hygrophoraceae.
11. Tricholomataceae, Entolomataceae.
12. Amanitaceae, Agaricaceae.
13. Coprinaceae, Bolbitiaceae, Strophariaceae, Cortinariaceae.
14. Russulaceae (Russula, Lactarius), Lycoperdaceae, Geastraceae, Sclerodermataceae, Phallaceae.

Suggested Literature:

Roger Phillips 1981: Mushrooms and other fungi of Great Britain and Europe

Name of the Course: Mushroom breeding		**Code:**
Lecturer: Dr. Péter Szeglet	**Semester:** winter / summer	
Lessons:	**Grading and Evaluation:** oral examination	**Credit:** 4

Aim of the Course:

The main purpose of this study to let the students know with the situation of mushroom breeding in EU, in Middle-East Europe and in Hungary. The students get information about the professional leading of Hungarian mushroom industry, about the work of skilled organisation and mushroom trade.

In the frame of practical training the students will be skilled in preparing the growing rooms, in the works of champignon and oyster mushroom breeding, in the pest control, using the hygiene, work, environmental and fire control roles.

Course Program:

1. The mushrooms in the nature. Mycology, and applied fields. Economical and catering importance of mushrooms. Curing effects of mushrooms
2. International and Hungarian story of mushroom breeding. Mushroom breeding, trade, and consuming in the word and in Europe. Factors affecting the development of Hungarian of mushroom industry.
3. Producing spawn, improvement, researches with variety, mother cultures.
4. The growing technology of champignon:
- growing rooms
- producing II. phase compost
- producing III. phase compost
- indoor composting
5. The growing technology of champignon in the II. and III. phase compost. Brown cap champignon, portobello mushroom.
6. Pathogens and pests, mushroom protection, hygiene roles.
7. Producing and using casing soils.
8. Extensive and intensive growing of oyster mushroom.
9. Growing technology of shiitake mushroom.
10. The possibility of mycorrhiza mushrooms, growing in plantation.
11. Growing of the Stropharia rugosoannulata and the so called exotic mushrooms.
12. Factory visit: **Damak Kft**. Zalavár.
13. Factory visit: Cziklin Zoltán **oyster mushroom grower** Keszthely-Kertváros

Suggested Literature:

Paul Stamets: The Mushroom Cultivator
Győrfi J. (szerk) 2010: Gombabiológia, gombatermesztés. Mezőgazda kiadó, Bp.
Professional periodical:

- Mikológiai Közlemények, publisher: Hungarian Mycological Society

Name of the Course: Fruit Production		**Code:** KEGNKEM112A
Lecturer: Dr. Gitta Molnár Dr. Kocsisné	**Semester:** winter / summer	
Lessons: 2	**Grading and Evaluation:** Written exam	**Credit:** 2

Aim of the Course: To learn about the world status of fruit production, the social and economic importance of fruits. To learn about the cultivation practices of fruit trees, pruning and propagation.

Course Program:

Advanced knowledge of propagation techniques and expected results of study production cycles of plants in nurseries and acquired

Knowledge of management of the orchard and the competences) physiological processes of the plant. Knowledge of techniques for manipulating the physiological processes such as pruning, application of growth regulators.

Physiological basis of fruit tree pruning.

Pruning model in fruit trees.

Technique to control vigour and enhance fruit formation.

Suggested Literature:

D. Alexander. 2009: Grafting and budding

Peter Dawson 1994: Handbook of horticultural students

Edward F. Gilman 2011. Pruning

Name of the Course: Environmental Soil Science		**Code:** KEGNNOM114A
Lecturer: Dr. István Sisák	**Semester:** winter / summer	
Lessons: 2+0	**Grading and Evaluation:** colloquium	**Credit:** 4

Aim of the Course:

Course description: The aim of the course is to explain the environmental role of soils, to show the relationship between geological and agricultural material cycles, to characterize soil degradation processes and soil fertility constrains and their elimination and to familiarize students with geographic information tools and their application in soil science and with existing soil monitoring systems.

Course Program:

Gaseous and geological material cycles on earth (origin and transport routes of materials on earth, minerals and rocks, main pools and pathways of material flow). The hydrologic cycle and the soil (soil water forms and soil water movement, water budget of soils at different vegetation covers, evapotranspiration, percolation, surface runoff). The carbon cycle (soil organic matter forms, decomposition of organic compounds, soils and the greenhouse effect, organic matter and soil properties, organic farming). The nitrogen cycle (N forms in soil, inputs and outputs, mineralization and immobilization, nitrate leaching). The phosphorus cycle (inorganic and organic P forms, P fixation capacity of soils). Eutrophication and agriculture (the role of N and P, point and non-point sources, models to describe P runoff and P turnover in natural waters). Cycles of other nutritive and toxic elements (Ca, K, S, Cd, Pb, Hg, Ni, Cr). Filter, transformation and storage functions of soil (soil porosity, water, C, N and P compounds). Constrains to soil fertility in Hungary and worldwide (detailed soil fertility constrain maps of Hungary). Soil degradation processes and their control: acidification (effective and hidden acidity, natural and man-made acidification, proton budget of soils, liming, lime requirement). Soil degradation processes and their control: salinization (natural prerequisites, natural and man-made salinization, irrigation water quality, possibilities of improvement of saline and sodic soils). Soil degradation processes and their control: erosion (runoff and soil erosion, forms of water erosion, inducing and influencing factors, USLE, wind erosion). The problems of sandy, clayey and shallow depth soils. Waste management and the soils. The FAO-UNESCO concept of agro-ecological zones of the world and the agro-ecological zones in Hungary. Soil spatial variability (small-scale and large-scale variability, delineating soil boundaries, soil maps, remote sensing tools for soil investigations: air photos, satellite imagery). Soil surveys and soil monitoring systems, GIS for the soil science.

Suggested Literature:

Stevenson, F. J. (1999). *Cycles of soils: carbon, nitrogen, phosphorus, sulfur, micronutrients*. John Wiley & Sons.

Sumner, M. E. (Ed.). (1999). *Handbook of soil science*. CRC press.

Reports of the Technical Working Groups Established under the Thematic Strategy for Soil Protection. EUR 21319 EN/ Volumes 1-5. Office for Official Publications of the European Communities, Luxembourg

Name of the Course: Integrated Production of Field Crops I.		**Code:** KEGNNOM243G
Lecturer: Dr. Sándor Hoffmann	**Semester:** winter / summer	
Lessons: 2+1	**Grading and evaluation:** final exam oral or written	**Credit:** 3

Aim of the Course:
The course will provide information on the modern, sustainable practice of field crop production. They will be able to manage, field production, specialized jobs, to control and improve production processes. In this part the general issues of plant production, (system of cultivar registration, seed quality standards, seeding methods), moreover cropping of different cereals and quality questions will be educated.

Course Program:
- History and importance of crop production
-(Seed low and regulation
- Commercial seed production
- The importance of cereals, wheat production
- Winter and spring barley
- Rye and Triticale production
- Oat production
- Rice production
- Sorghums and millets, their production

Suggested Literature:
Martin, J. H.- Waldren, R. P. – Stamp, D. L. Principles of Field Crop Production.
Pearson-Prentice Halls; Upper Saddle River, New Jersey, Colombus Ohio Fourth edition 2006.
Selected literature:
Gooding M. J. – Davies W. P. Wheat Production and Utilization. CAB INTERNATIONAL New York 1997.
Journals:
Agronomy Journal, Crops and Soils

Name of the Course: Integrated Production of Field Crops II.		**Code:** KEGNNOM142C
Lecturer: Dr. Sándor, Hoffmann	**Semester:** winter / summer	
Lessons: 1+1	**Grading and evaluation:** final exam, oral or written	**Credit: 2**

Aim of the Course:
The course will provide information on the modern, sustainable practice of field crop production. They will be able to manage, field production, specialized jobs, to control and improve production processes. In this part II., cropping of maize, arable legumes (soya bean), oil seed crops (oilseed rape, sunflower), root crops (potato), leguminous rough fodder (alfalfa), will be discussed. The modern integrated, sustainable methods of arable cropping, preservation and storage and quality questions will be discussed.

Course Program:

1**.** Production of maize
2. Protection of maize against pests and diseases
3. Production of potato
4. Protection of potato against pests and diseases
5. Production of soybean
6. Production oilseed rape (canola)
7. Production of sunflower
8. Production of alfalfa

Suggested Literature:
Martin, J. H. - Waldren, R. P. – Stamp, D. L. Principles of Field Crop Production.
Pearson-Prentice Halls; Upper Saddle River, New Jersey, Colombus Ohio Fourth edition 2006.
Selected literature:
Gooding M. J. – Davies W. P. Wheat Production and Utilization. CAB INTERNATIONAL New York 1997.
Journals:
Agronomy Journal, Crops and Soils

Name of the Course: Nutrient Management		**Code:** KEGNNOM243H
Lecturer: Dr. Katalin Sárdi, Professor	**Semester:** winter / summer	
Lessons: 2+1	**Grading and Evaluation:** Students are expected to attend the courses including lectures and lab sessions. General course requirements: based on the Regulations of University of Pannonia, 17. §. Absence from classes should not exceed the maximum according to 9. §.9. Personal electronic devices (mobile phones, MP3, MP4 players, cameras etc. are not allowed during classes and lab sessions. Examination and Evaluation: Final grades will be calculated from the results of qualification of the work: on an individual basis, c.) written examinations, d.) essays, e.) oral examinations. For excellent works, efficiencies, outstanding results etc., extra points may be earned. Minimum requirement of written examinations: 55 percent.	**Credit:** 3

Aim of the Course: The course will provide information on soil-crop nutrient interrelations including environmental aspects of sustainable, integrated nutrient management. Students will become familiar with the actual concepts of fertilizer recommendation systems and will be able to make calculations for the optimum fertilizer rates and nutrient balances of crop production. Students are introduced to the concept on sustainable agricultural production minimizing the environmental impact of fertilization.

Course Program:

Introduction to Nutrient Management: Principles and Practices,
Regulation in Nutrient Management, Criteria of Good Agricultural Practices (GAP)
Interrelations in the Soil-Crop-Nutrient System and its Role in Efficient Nutrient Management.
Calibration of Soil Tests and Plant Analyses, Data Interpretation
Relationship between Nutrient Supply and Yields, Application of Models.
The Role of Site Characteristics in Soil Fertility and Nutrient Management.
Soil Fertility Evaluation: Greenhouse and Field Tests.
Phylosophies and Methods of Fertilizer Recommendation (DRIS etc.).
Role of Nutrient Balance Assesssment, Application of Agronomic and Environmental Approaches
Common Fertilizers and Application, Efficiency. The role of organic fertilizer substances in nutrient management.
Determination of Optimum Fertilizer Rates.
Concept of Site-Specific Nutrient Management: Precision Agriculture.
Alternatives in Nutrient Management: Low Input Sustainable Agriculture, Organic Farming etc.
Ecological aspects of nutrient management.
Environmental aspects of nutrient management.

Suggested Literature:

Sárdi Katalin (2011) Nutrient Management. 124 p. e-learning. www.georgikon.hu/moodle

Sárdi Katalin (2013) Laboratory Manual. e-learning. www.georgikon.hu/moodle

Soil Fertility and Fertilizers. (Havlin et al.) Seventh Edition. Pearson Prentice Hall, New Yersey, 2005.
Soil Fertility and Plant Nutrition. (in: Handbook of Soil Science, ed. By M.E. Sumner). Section D. pp. 1- 186. CRC Press Boca Raton, London. New York 2000.
The Impact of Fertilization on the Environment. In: Pollution and Water Resources. (Debreczeni, K. – Sárdi, K.) Columbia University Seminar Series, Ed. By G.J. Halasi-Kun. Volume XXIX. 1995-1997.
SOIL FERTILITY AND CROP PRODUCTION. Ed. By K.R. Krishna (2002) Science Publisher, Inc. UK.
SOIL FERTILITY AND PLANT NUTRITION. E.J. Kamprath. In: Handbook of Soil Science, Section D. Ed. by M.E. Sumner. (2000) CRC Press USA.
SOIL FERTILITY, FERTILIZER and INTEGRATED NUTRIENT MANAGEMENT. (2009). Oxford Book Company.

Name of the Course: Research Methodology		**Code:** KEGNNOM143E
Lecturer: Dr. Katalin Sárdi, Professor	**Semester:** winter / summer	
Lessons: 2+1	**Grading and Evaluation:** Students are expected to attend the courses including lectures and laboratory sessions. Absence from scheduled lectures and lab sessions is strongly discouraged. General course requirements: based on the Regulations of University of Pannonia, 17. §. Absence from classes should not exceed the maximum according to 9. §.9. Personal electronic devices (mobile phones, MP3, MP4 players, cameras etc. are not allowed during classes. Examination and Evaluation: Final grades will be calculated from the results of qualification of the work on individual basis: b.) calculations, c.) written examinations, d.) essays, e.) oral examinations. For excellent works, efficiencies, outstanding results etc., extra points may be earned. Minimum requirement of written examinations and/or lab tests: 55 percent.	**Credit:** 4

Aim of the Course: The main purpose of the course is to introduce students into concepts, experimental considerations, planning and designing of experiments used in agriculture (plant, animal and economic sciences) to develop students' skills in statistical methodology used for data processing and interpretation as well as to solve the questions at the level of Master's degree in Agriculture.

Course Program:

Part I : General knowledge

General knowledge on the research methodology in agriculture (in vivo, in situ, in vitro, etc.). Data collection and processing from scientific literature, analytical methods of experimental materials, writing scientific papers. Analysis and data interpretation, use of statistical methods. Use of controlled environments and model experiments. Development and growth patterns in biology. Life cycles of individuals, populations and communities.

Part II : Experiments in Plant Sciences

Plant growth and development: biomass production and energy storage. Principles of qualitative and quantitative plant growth analysis. Molecular cloning and identification of genetically modified organisms. Methodology of greenhouse experiments. Planning considerations. Pot size, preparation of soil. Experimental Designs, treatments and replicates.

Methodology of field experiments. Planning considerations. Experimental error. Designs, plot size, split plot, soil heterogeneity. Treatments and replicates. Long-term field experiments.

Part III : Experiments in Animal Sciences

Design, methods and evaluations applied in animal science. Principals of field, model, *in vivo* and *in vitro* experiments. Methods of data collections, sampling procedures of animals, tissue, blood urine and faeces collection. Planning and evaluation of experiments in animal physiology. Digestion experiments on farm animals. Planning and application of model experiments with animals.

Methodology of balance trials, different methods used for the determination of the energy content of feeds. Determination the nutrient requirements values of farm animals. Carrying out feeding trials, arrangements, evaluation of the results.

Part IV: Experiments in Economic and Social Sciences

Problem definition and research question. Primary and secondary data. Qualitative and quantitative research methods. Exploratory research design: in-depth interviews, focus groups, projective techniques. Descriptive design: cross-sectional and longitudinal. Survey methods: personal interviews, telephone, mail and online interviews. Methods of observation. Sampling techniques. Questionnaire design. Report preparation and presentation.

PROGRAM OF PRACTICES:

Linear relations between quantitative variables Nonlinear relations between quantitative variables. Relations between categorical variables Multivariate analysis (Factorial ANOVA, MANOVA etc.) Multiple regression

Suggested Literature:

CONTROLLED ENVIRONMENTS FOR PLANT RESEARCH. Downs, R.J. Columbia University Press, New York. 1975.

A MODERN TOOL FOR CLASSICAL PLANT GROWTH ANALYSIS. R. Hunt, D. R. Causton, B. Shipley and A. P. Askew. *Annals of Botany* 90: 485-488, 2002

GREENHOUSE MANAGEMENT. Hanan, J.J., Holley W.D., Goldsberry. Springer Verlag, Heidelberg. 1978.

WRITING and PRESENTING SCIENTIFIC PAPERS. 2nd Edition. B. Malmfors, P. Garnsworthy, M. Grossmann. Nottingham University Press, 2000.

DESIGN OF EXPERIMENTS FOR AGRICULTURE AND THE NATURAL SCIENCES. A.R.Hoshmand. CRC Press, 2006.

AGRICULTURAL FIELD EXPERIMENTS: DESIGN AND ANALYSIS. Roger G. Petersen. CRC Press, 1994.

LONG-TERM FIELD EXPERIMENTS. Keszthely. Kismányoky, T. – Balázs, J. 1996. PATE-Georgikon

MOLECULAR CLONING. Sambrook, Fritsch, Maniatis, Cold Spring Harbor Laboratory Press 2004.

DESIGN OF ANIMAL EXPERIMENTS. Eide, D. M.: www.oslovet.veths.no/compendia/LAS/KAP28.pdf

ESSENTIALS OF MARKETING RESEARCH. Proctor, T. Pearson Prentice Hall, 2005.

MANAGEMENT RESEARCH METHODS. Tharenou, P. Donohue, R., Cooper, B. Cambridge University Press | 2007

DESIGNING SOCIAL RESEARCH. N Blaikie. Polity Press, 2000.

Name of the Course: Methodology in Pot Experiments		**Code:** PEDIGKNK39
Lecturer: Dr. habil. Katalin SÁRDI, CSc **Co-lecturer:** Dr. Tibor Janda, DSc, CAR of HAS	**Semester:** winter / summer	
Lessons: 32 (14 contact lessons + 8 hours practice + 10 hours individual work	**Examination and Evaluation:** Final grades will be calculated from the results of qualification of the work: on an individual basis, c.) written examinations, d.) essays, e.) oral examinations. For excellent works, efficiencies, outstanding results etc., extra points may be earned. Minimum requirement of written examinations: 55 percent.	**Credit:** 4

Aim of the Course:

The aim of the course is to provide information on pot experiments, methods and media commonly used in greenhouses and phytotronics, preparation and technical requirements, main aspects of evaluation and data interpretation from results.

Course Program:

Importance of pot experiments in the studies of nutrient dynamics. Methods and media commonly used in pot experiments: sand, soil, natural and artificial growing media. Greenhouses and phytotronics.

Methodological requirements in pot experiments. Planning and design of the experiments (treatments, duration, test plants, soil types etc.). Preparation of soils/growing media, pot size and types. Amounts and chemical forms of nutrients and their ratios, balanced and imbalanced supply. Sowing, number of plants per pot, phytotechnics, water supply and control. Environmental requirements of experiments conducted in greenhouses and under controlled conditions (light, temperature, humidity etc.). Technical conditions of experiments. Parameters to be measured during the experiment and requirements of the harvest. Main aspects of evaluating the results. Interpretation and application of results.

Practice: preparation, setting, conduction and harvesting of the experiments: preparation of soils and other growing media. Preparation of fertilizers and seeds. Application of phytotechnics during the experiments. Presentation of methodologies in the greenhouse. Visiting the phytotronics and experiments under controlled environments in the Center of Agricultural Research of the Hungarian Academy of Sciences (CAR of HAS) in Martonvásár.

Suggested Literature:

Bergmann, W. : Ernahrungsstörungen bei Kulturpflanzen. Gustav Fischer Verlag Jena-Stuttgart 1993.

Chouard, P. - Bilderling, N. : Phytotronics in agricultural and horticultural research. Gauthier-Villars, 1975.

Downs, R.J.: Controlled environments for plant research. Columbia Univ. Press, New York, 1975.

Ellis, C. (2002): Soilless growth of plants. New Delhi, Agrobios. 278 p.

Giesecke, F. Der Vegetationversuch . 2. Der Gefassversuch und seine Technik. Metodenbuch, Band IX. Neumann Verlag, Radebul und Berlin. 1954.

Hanan, J.J. - Holley, W.D. - Goldsberry, K.L.: Greenhouse management. Springer Verlag, Heidelberg, 1978.

Mastalerz, J.W. : The greenhouse environment. John Wiley and Sons, New York-Toronto, 1977.

Tischner, T. - Kőszegi, B. - Veisz, O.(1997): Climatic programmes used in the Martonvásár phytotron most frequently in recent years. Acta Agron. Hung. 45: 85-104.

Name of the Course: Environmental Impacts of Agricultural Production		**Code:** KEGNNOM213A
Lecturer: Dr. Katalin Sárdi, Professor	**Semester:** winter / summer	
Lessons: 2+0	**Grading and Evaluation:** Final grades will be calculated from the results of qualification of the work: on an individual basis, c.) written examinations, d.) essays, e.) oral examinations. For excellent works, efficiencies, outstanding results etc., extra points may be earned. Minimum requirement of written examinations: 55 percent.	**Credit:** 3

Aim of the Course:
The main purpose of the course is to provide information on agro-chemicals, impacts of agricultural activities such as crop production (including fertilizer and pesticide application) and animal husbandry on environmental pollution (soil, water and atmosphere), legislation in fertilizer use, characteristics of soil, water and air pollution caused by agricultural emissions as well as the essential information on regulation both at national and international level (protocols etc.)

Course Program:
The role of agrochemicals in the environmental contamination. Contribution of fertilization and animal husbandry to the environmental impacts. Interrelations in the fertilizer-soil system. Regulation of nutrient load originating from agricultural production: the „Nitrate Directive". Contamination of the soil-plant-animal-human food chain with heavy metals. Characteristics of soil, water and atmospheric load and pollution. Groups of pesticides and the characteristics of pesticide contamination. Greenhouse gases and their environmental aspects. The role of international legislation and strategies in environmental quality protection (soil, water, atmosphere). Role and application of environmental indicators and environmental analysis (LCA).

Suggested Literature:
ENVIRONMENTAL IMPACT OF AGRICULTURAL PRODUCTION. Sárdi, K. 2014. Textbook for MSc Students in Agriculture. University of Pannonia, Georgikon Faculty. www.georgikon.hu/Moodle

AGRICULTURAL POLLUTION. Environmental Problems and Practical Solutions. Merrington, G. et al. SPON Press, London & New York. 2002.

AGRICULTURE, FERTILIZERS AND THE ENVIRONMENT. Lægreid, M. – Bøckman, O.C. and O. Kaarstad. (1999) CABI Publishing.

THE IMPACT OF FERTILIZATION ON THE ENVIRONMENT. Debreczeni Bné- Sárdi K. (1997). Columbia University Seminar Proceedings. pp. 190-210.

FERTILIZATION AND THE ENVIRONMENT. Ed. by Merckx, R. et al. (1990). Leuven University Press.

SOILS AND ENVIRONMENTAL QUALITY. T.J. Logan. In: Handbook of Soil Science, Section G. Ed. by M.E. Sumner. (2000) CRC Press USA.

THE EUROPEAN ENVIRONMENT – State and Outlook 2005
http://www.eea.europa.eu/hu/publications/state_of_environment_report_2005_1

ENVIRONMENTAL REPORT OF HUNGARY, 2008. Hungarian Central Statistical Office.

Name of the Course: Sustainable Agricultural Production		**Code:** KEGNNOB242B
Lecturer: Dr. Zoltán Tóth	**Semester:** winter / summer	
Lessons: 1+1	**Grading and Evaluation:** Written colloquium	**Credit:** 2

Aim of the Course:
Based on previously learned ecological and economical knowledge the students will be familiar with the methods of sustainable agricultural production, as well as with the environmental effect of agriculture and with the role of agriculture in the renewable energy production.

Course Program:
Introduction. Calculating the ecological footprint.
Cycles in the nature
The limits of agricultural production
Regional cropping systems
Renewable resources in the agriculture
Biogas and biofuel. Biomass C, N, P, K cycles
Erosion and sustainable soil management
Fitting crops to the soils, monoculture and crop rotation
Organic manure management
Mineral fertilization
Agrochemicals and pollution, soil contamination, food safety

Suggested Literature:
Handout material.
Soil Fertility Management for Sustainable Agriculture. Rajendra Prasad, James F. Power. 1997 by CRC Press LLC.
Principles of Sustainable Soil Management in Agroecosystems. Edited by Rattan Lal and B.A.Stewart. 2013 by Taylor & Francis Group, LLC. CRC Press.

Name of the Course: Land Use		**Code:** KEGNNOM142B
Lecturer: Dr. Zoltán Tóth	**Semester:** winter / summer	
Lessons: 1+1	**Grading and Evaluation:** Oral colloquium	**Credit:** 2

Aim of the Course: Teaching such fields of knowledge that are based the previously studied subject „soil management and land use" and complete it in the field of rational site specific and soil conserving land use methods using novel informatic tools in the ecological sound land use planning. Introduction of the basics and principals as well as the regulations of site specific land use in different agroecolgical regions.

Course Program:

Classical cropping systems
Land use systems in the present
Relationship between biodiversity and soil degradation processes
Effect of land use on the pollution of soil and water resources as well as on food quality
Agricultural use of waste materials and by-products
Principles of environment management and site specific regional cropping, the system of land use zones
Aspects environment management and site specific regional cropping
Aspects of organic matter management and its global importance
The frame of the introduction of environment management and site specific regional cropping in the practice, the National Agroenvironment Management Program and the National Rural Development Strategy
Agroecological and agricultural properties of the Hungarian regions
Basics of adaptable farm structure planning
Development and aspects of land use branches
Land qualification, land evaluation
Application of Geological Information Systems (GIS) in the planning of land use patterns
The register of land, rules and regulations of land use and soil conservation

Suggested Literature:

Handout material
The Agricultural Notebook. Edited by Richard J. Soffe Seale-Hayns University of Plymouth UK. Blackwell Science 2003.
Environmentally-sound adaptable tillage. Márta Birkás, Akadémiai Kiadó Budapest 2008.
Soil Management: A World View of Conservation and Production. Ray L. Cook, Boyd G. Ellis. 1987
Soil Conditions and Plant Growth. Edited by Peter J. Gregory and Stephen Nortcliff. Wiley-Blackwell 2007.

Name of the Course: Soil and water in rangeland systems		**Code:** KEGNNOM243I
Lecturer: Dr. Brigitta Tóth, Dr. Gergely, Tóth	**Semester:** winter / summer	
Lessons: 2+2	**Grading and Evaluation:** Grading is based on a midterm and a final written examination. The whole content of lectures is included in the final written examination. The final mark is determined according to following table based on the weighted average of the two written examinations (midterm 33%, final written examination 67%): Points — Final mark above 85 — excellent (5) 70-85 — good (4) 60-69 — medium (3) 50-59 — pass (2) below 50 — fail (1)	**Credit:** 3

Aim of the Course:

The aim of the course is:

- to introduce the students the most important characteristics and behaviour of soil elements;
- to give an overview on soil forming processes and soil classification systems;
- to introduce the elements of the soil water balance and soil water regime types;
- to give knowledge on the interpretation of soil data.

Course Program:

Function of soils - agricultural, ecological, engineering, cultural aspects.

Major elements in soil and their behaviour.

Organic and inorganic soil colloids, charge of colloids, characteristics of the double-layer.

Soil formation processes: physical and chemical weathering, humification, leaching, accumulation of clay, accumulation of organo-metallic complexes, podzolization, salinization, sodification, gleying, oxido-reduction.

Soil horizonation: master horizons and layers, subordinate distinctions within master horizons, transitional horizons.

Soil profile description.

Interpretation of soil analytical data.

Hydrologic cycle, soil water balance, soil water regime types.

Soil classification, introduction to Soil Taxonomy, systems of the World Reference Base: reference soil groups, most important diagnostic horizons, properties and materials.

Different scale soil information systems in Europe, accessibility of soil data.

The use of Soil Databases for planning (land use, nutrient management, modelling etc.) at regional and global scales.

Suggested Literature:

Brady N.C., Weil R.R. 1999. The Nature and Properties of Soils. Prentice Hall, Upper Saddle River, New Jersey.

Handbook of Soil Science (Ed. by Sumner, M.E.) 2000. CRC. Press

Section A. Chapter 3, 4 and 5: Soil Water Content, Soil Water Movement Energy and Water Balances.

Section H. Soil Databases. Chapter 6. The Use of Soil Databases in Resource Assessments and Land Use Planning.

IUSS Working Group WRB. 2014. World Reference Base for Soil Resources 2014. International soil classification system for naming soils and creating legends for soil maps. World Soil Resources Reports No. 106. FAO, Rome.

Soil Survey Staff. 2014. Keys to Soil Taxonomy, 12th ed. USDA-Natural Resources Conservation Service, Washington, DC.

Name of the Course: Biometrics		**Code:** KEGNGMM242C
Lecturer: Dr. Márta Hunkár Zemankovics	**Semester:** summer	
Lessons: 1+1	**Grading and Evaluation:** based on midterms and home works	**Credit:** 3

Aim of the Course:

This course introduces into the mathematical-statistical methods applied in biological sciences. Due to the enormous variability of biological phenomena methods are based on the theory of random variables and characterisation of the population using samples.

Course Program:
Prerequisites: Basic courses in Mathematics and Statistics

1. Population and sample, types and alters of variables, scales.
2. Characterization of the sample: empirical distribution, averages, dispersion (or diversity when the variable is qualitative).
3. Characterization of the population theoretical distribution, averages, dispersion.
4. Notable discrete distributions: binomial, Poisson
5. Notable continuous distributions: uniform-, exponential- and normal distributions.
6. Some statistical distributions derived from normal distributions.
7. Estimation of the parameters, confidence-intervals.
8. Principles of testing of hypothesis, errors in decisions.
9. Testing of relations I.: Analysis of Variance.
10. Testing of relations II. Correlation and Regression, Probit-analysis.
11. Testing of relations III: Analysis of the Contingency Tables. Associations', diversity.
12. Some practical applications.

Suggested Literature:
Internet: **www.stattrek.com**; www.onlinestatbook.com
Text books:
MOHAMMED A. SHAYIB: Applied statistics. Bookboon.com (2013)
SOKAL, R. R.- ROHLF, F. J.: Introduction to biostatistics. Dover Publ. New York 2009
SOKAL, R. R.- ROHLF, F. J.: Biometry , W.H. Freeman and Co. (Fourth edition) 2012

Name of the Course: Geographic Information System-GIS		**Code:** KEGNGMB244B
Lecturer: Dr. János Busznyák	**Semester:** summer	
Lessons: 2+2	**Grading and Evaluation:** 2 tests and 3 assignments during term. There is one chance to rewrite a missed test within the term. Condition of signature to subject: both tests with at least satisfactory result, assignments of adequate quality handed in until deadline, adequate level of class tasks. Another condition is to keep to TVSZ (study and examination rules). Subject is closed with an exam. Evaluation is made up of the two test results the assignments, as well as the exam result.	**Credit:** 4

Aim of the Course:

Basic concepts of GIS and related disciplines (GIS, GNSS, 3D, Digital mapping, remote sensing…). Technological background to GIS systems: hardware and software elements. Raster and vector GIS, use of vector and raster data models. Creation of thematic digital spatial database. Automatic and manual data collection: manual scanned procession, terrain geodesic procedures, remote sensing, photogrammetry, alfanumeric databases, digital sets, GNSS. Characterisation of data quality. Planning and creating GIS systems. Mapservers, GIS standards, spatial decision supporting systems. Specific uses of GIS.

Course Program:

I. Basic concepts of GIS
II. GIS related disciplines
III. Software and hardware elements of GIS systems
IV. Raster and vector GIS
V. Creation of thematic digital spatial database I.
VI. Creation of thematic digital spatial database II.
VII. Digital mapping: output, data quality characterisation
VIII. Basics of remote sensing
IX. Collection of remote sensing data
X. Procession of remote sensing data
XI. Preparation of GNSS measurement
XII. Evaluation of GNSS measurement
XIII. Uses of 3D data
XIV. Application of mapservers, spatial decision supporting systems

Suggested Literature:

Basic of material is theoretical and practical knowledge given during classes.

Busznyák, J: Application of GIS in Plant Protection
Busznyák, J: Information Technology in Plant Protection
ArcGIS user guide
Georgikon MapServer user guide; Georgikon BaseStation user guide
Busznyák, J: GIS basic tasks (ArcGIS 10)
The NCGIA Core Curriculum in GIScience 2000.
http://www.ncgia.ucsb.edu/pubs/core.php
Microsoft Virtual Earth, Live Search Maps
Spatial Data Infrastructures in Europe: State of play 2007.
http://inspire.jrc.ec.europa.eu/reports/stateofplay2007/INSPIRE-SoP-2007v4.pdf GPS basic knowledge;
Trimble GPS for Precision Agriculture Centimeter Accuracy & RTK
http://www.trimble.com/ag_gps.shtml; United States Naval Observatory (Usno) Block Ii Satellite Information. ArcNews ISSN 1064-6108; ArcUser ISSN 1534-5467;
GISDATA Published by: GISDATA Group; ERROR; Trimble News Room;

Name of the Course: Application technology of plant protection machines		**Code:** MNAMN01K201
Lecturer: Dr. Béla Pályi	**Semester:** winter / summer	
Lessons: 2+2+0	**Grading and Evaluation: K** **General requirements**: • According to the University Policies, a maximum of 35 % absence (lecture and practice) acceptable. • Two written examination paper writing effectively. The written examination papers have theoretical and practical questions. The acceptance condition min. 2.0 results in both. • The department of education can issue other tasks (e.g. machine adjustment, measuring, calculation) to perform. • A student who has not completed all course requirements will receive a note prior to the last week of the semester. When the written examination requirements not completed, receive an opportunity for the supplementation. **Exam requirements:** • The form of the final exam written. • A student who has continuous good performance during the semester, receive releasement of an examination, which has requirements the written examination papers in this thesis min. 3.0 average grade.	**Credit:** 4

Aim of the Course: The BSc qualified, the plant protection work in carrying out agricultural engineers are aware of the principle of operation of machinery and tools used, the structure, the characteristics of the application. Have any technical knowledge about the correct choice of the machines set up, operation, maintenance, and can carry out, or assist in performing tasks.

Course Program:

Plant protection methods, systematization, characterisation their machines and equipments.
Constructional characterisation and functional comparing assessment of hydraulic and air assisted sprayers. ULV and Controlled Droplet Application technique. Equipments and attributes of electro statically charged sprays. Local treatment. Closed-circuit system sprayers. Spray solution making methods, mixing equipments. Aerial application. Seed treatment. Dosage devices of corn, liquid and powder. Monitors, control systems. Environment-friendly methods, equipments of precision application.
Connection of engine and machine, machine operation, operation-coupling, control resolutions. demonstration and operation of machine constructions. Determinant parameters of spraying quality (effect of material, plant, climate, operating parameters). Work quality parameters, their measurements, demands (liquid dosage, discordance of nozzles, wearing, spraying angle, and dosage accuracy of spraying boom). Measurements of micro distribution parameters (drop size, coverage, number of drops). Parameters, demands of drop size, and spray pattern. Working adjustment of spray dose. Directives of EU compatible quality control and quality assurance of spraying equipments, mandatory control system. Spray control systems, area specific treatment.

Suggested Literature:

1. G.A. Matthews (2000): Pesticide application methods, 3rd Edition. Wiley Blackwell
2. Michael F. Wilson (2004): Optimising pesticide use. Wiley.
3. Donnel Hunt (1983): Farm Power and Machinery Management. Iowa State Press.
4. SWR Cox (1997): Measurement and Control in Agriculture. Hardback.
5. Ganzelmeier-Wehmann (2007): Second european workshop on standardised procedure for the inspection of sprayers in Europe. Berlin-Braunschweig.
6. Claude Culpin (1992): Farm machinery, 12th Edition. Wiley-Blackwell

Name of the Course: Pesticide chemistry		**Code:** MNNVN01K300
Lecturer: Dr. Erzsébet Nádasy, István Somlyay	**Semester:** winter / summer	
Lessons:	**Grading and Evaluation:**	**Credit:** 3

Aim of the Course:

Importance of chemical plant protection, knowledge of pesticides to chose the most suitable pesticide to protect the crops.

Course Program:

Definition of pesticide. Importance of pesticides in the world and in Hungary. Nomenclature and physical chemistry of pesticides. Classification of pesticides by biological effect and by mode of action. Methods of pesticide usage. Formulation of pesticides. Definition of LD_{50}, EC_{50}, and examinations for legislation of pesticide.

Classification and representation of fungicides groups according to the chemical structure. Contact and systemic fungicide groups. Common name of active ingredients, biochemistry, mode of action and their application.

Classification and representation of insecticides groups according to the chemical structure. Neurotoxins and insect growth regulator groups. Common name of active ingredients, biochemistry, mode of action and their application.

Classification and representation of herbicides groups according to the chemical structure. Pressowing, preemergence and postemergence herbicides. Common name of active ingredients, biochemistry, mode of action and their application.

Suggested Literature:

Matolcsi, Gy., Nádasy, M., Andriska, V.: Pesticide Chemistry. Akadémiai Kiadó, Budapest, 1988.

C. MacBean (Ed.): A World Compendium The Pesticide Manual Sixteenth Edition, BCPC (British Crop Production Council) 2012.

Name of the Course: Weed management		**Code:** MNNVN01K320
Lecturer: Dr. Erzsébet Nádasy, Domonkos Lukács	**Semester:** winter / summer	
Lessons:	**Grading and Evaluation:**	**Credit:** 4

Aim of the Course:

Students introduce to important and problematic weeds and integrated weed management of arable fields, vegetables and orchards.

Course Program:

- Methods of integrated weed management. Mechanical, agrotechnical and chemical weed control methods.
- Weeds and integrated weed management of important field crops: winter wheat, maiz, rice, sunflower, oil seed rape, soybean, alfalfa, pea, potato and sugar beet.
- Weeds and integrated weed management of vegetables: tomato, red pepper, onion, cucumber, cabbage, carrot and parsley.
- Weeds and integrated weed management of orchards: apple, stone-fruits, berry fruits, and vineyard.

Suggested Literature:

1. Harminder Pal Singh, Daizy Batish, R. K. Kohli: Handbook of Sustainable Weed Management Haworth Press 2006.
2. Carole A. Lembi, Merrill A. Ross: Applied Weed Science. Third edition 2008
3. Robert E. L. Naylor: Weed Management Handbook, 9th Edition, Wiley-Blackwell 2002.

Name of the Course: Toxicology and ecotoxicology		**Code:** MNNVN01K310
Lecturer: Dr. Péter Budai	**Semester:** winter / summer	
Lessons:	**Grading and Evaluation:**	**Credit:** 3

Aim of the Course: During the education of subject the undergraduates learn the principles and methods of toxicology and ecotoxicology.

Course Program:

General principles of toxicology
Brief history of toxicology
Terminology
Dose-response relationship
Factors affecting toxicity
Toxicodynamics
Toxicokinetics
Specific types of toxic response:
- teratogenicity
- genotoxicity
- carcinogenicity

Toxicological and ecotoxicological testing methods
Human and Environmental Risk Assessment

Suggested Literature:

Hayes, A.W. (ed).: Principles and Methods of Toxicology. Raven Press, New York, 1986.

Casarett, L.J.: Casarett and Doull's Toxicology: The Basic Science of Poisons. Macmillan Publ. Co., In.., New York, 1980.

Landis, W. G., Ming-Ho Yu.: Introduction to Environmental Toxicology. CRC Press, 1995.
Hoffman, D. J., Rattner, B. A. (eds). Handbook of Ecotoxicology. CRC Press Inc., 1994.

Marrs, T. C., Ballantyne, B. (eds): Pesticide Toxicology and Intenational Regulation. Wiley, 2003.

Krieger, R. (ed): Handbook of Pesticide Toxicology. Third edition. Academic Press, 2010.