

BIODIVERSITY, UNDERGRADUATE STUDY PROGRAMME, FIRST BOLOGNA CYCLE

COURSE DESCRIPTIONS

COMPULSORY COURSES

Course name: **GENERAL BOTANY**

Number of ECTS credits: **6**

Content:

The students are introduced to the general concepts of general botany, which represents the basis of other basic and applied fields of botany as well as the broader field of the sciences of life. Students learn and understand the basic structure of plant organisms on the level of macromolecules, subcellular microstructures, cells, tissues and whole organism. Emphasis is given to the adjustment of plant life in different environments both at cellular, anatomical and morphological level. Students learn the basic principles and forms of reproduction. Theoretical knowledge that students acquire during lectures is enhanced during laboratory work.

Course name: **GENERAL ZOOLOGY**

Number of ECTS credits: **6**

Content:

General zoology provides basics of zoological science that is important for understanding zoological objects (i.e. basic and applicative zoological objects) through further study years. The objectives of general zoology are animal structure (morphology, anatomy), function, and basics of biodiversity (i.e. the processes that enable life and its continuation). It also provides the basics of Darwin's evolution and theories of origin of life. The knowledge on structure is given through different levels: cytology histology, organography. Furthermore, the phylogenetic classification is explained, including the history of its development, its principles and rules of zoological nomenclature with cladistics. The systematics is represented as different hypotheses, not facts. Students can therefore also acknowledge the limits in the interpretation of fossil data and in construction of taxonomical and phylogentic systems. The object also gives the theoretical basics of species definitions in zoology.

Course name: **GENERAL AND INORGANIC CHEMISTRY**

Number of ECTS credits: **6**

Content:

The course presents the basic chemical laws. Students learn the basics of quantitative characteristics and structure of matter, chemical processes and electronic configuration of atom, types of chemical bonds, chemical reactions, chemical equilibrium and energy changes in chemical reactions.

The first part is made from brief summary of the substance and material changes and chemical laws; second part is upgraded with explanation of basic chemical concepts: atom, molecule, ion, element, compound, substance, mixture, formulas, etc. Students are introduced to the computational exercises. Scope of atomic and chemical bonds is focused on the importance of the chemical bonds within atoms and molecules and on the structure of periodic table of elements. A basic overview of the dispersants systems and chemical equilibrium within the reactions. Review of

inorganic compounds is given according to the periodic table of elements and review of organic compounds is with functional groups. Students acquire the basic chemical education which is key to every naturalist, and his effect on the labor market. At the same time, students learn to use critical analysis and development, practical application of theories in solving practical problems in the field of chemistry. The subject is the basis for other chemical objects in the program, and serves as a balancing of chemical knowledge, which the students bring from high school. Students upgrade theoretical knowledge acquired by lectures, with practical examples in the context of computational and laboratory exercises.

Course name: BASIC PHYSICS WITH BIOPHYSICS

Number of ECTS credits: 6

Content:

The subject presents a comprehensive basis of physics and biophysics both in its theoretical and practical aspects. We introduce the basic physical concepts, which are the basis for understanding processes in living beings. The importance of these concepts is further fortified with explanations and with real examples. Students learn about the rich and additive physical quantities and operating procedures for measuring these quantities, forms of energy, material, electrical and thermal currents, conservation laws, oscillations and waves. They accurately understand biophysical applications such as biomechanics, pressure and concentration differences as a cause for material flows, temperature differences as a cause for heat flow, potential difference as the cause for electrical currents, vocal chords as sound transmitter and biophysical structure of ears as a sound receiver, optical instruments and basics of molecular biophysics. Physics and biophysics are an essential part of the study and understanding of physical phenomena in chemistry, biology and medicine, as in ecology. Students are acquainted with the understanding of theoretical and practical problems that they will encounter in laboratory research work, or in industry.

Course name: MATHEMATICS

Number of ECTS credits: 6

Content:

Students gain knowledge of basic concepts and methods in mathematics, especially in the case of functions of one real variable. In tutorials they obtain a practical working knowledge of the subject. Students learn mathematical thinking and learn about rigorous mathematical language.

Aims:

- Understanding of real numbers and the associated calculations.
- Understanding the Gaussian method of solving linear equations.
- Understanding the concept of matrices and basic operations with them.
- Understanding the importance of sequences, limits, and accumulation points.
- Understanding the continuity of function.
- Understanding the derivative and its use in problem solving of extremal calculation.
- Understanding the concept of integrals and use in solving physical and geometric functions.

Course name: INTRODUCTION TO COMPUTER SCIENCE

Number of ECTS credits: 6

Content:

The structure of computers and basic concepts with mechanisms of operational systems are provided. Furthermore, students get familiar with use of mechanisms in software (e.g. password changing, e-mailing, signing into programmes a.s.o.). The basics of Linux system and computer languages are also explained.

The stress is upon use of some software programmes, e.g. for text editing, work with data (tables) and systems for numerical treatment of mathematical equations. Team work is stressed and through this, also the development of organisation and communication skills. The course also provides the possibility of development of observational skills, seeking for information and critical judgement.

Course name: SYSTEMATIC BOTANY AND GEOBOTANY

Number of ECTS credits: 6

Content:

The aim of the course is to acquaint the students with principles of systematic botany, plant evolution and geobotany. The Slovenian vegetation and flora is stressed, which provides the basics for understanding the biodiversity patterns in Slovenia as well as abroad. Slovenia (especially its SW part) with its high biodiversity is a country where the elements of different regions meet is a great place for studying the floral biodiversity and vegetation. The course also provides the addition to the General botany course from the 1st grade. The course gives the important knowledge of domestic flora and vegetation, two important elements of national natural heritage.

Course name: BIODIVERSITY AND ECOLOGY IN THE MEDITERRANEAN

Number of ECTS credits: 6

Content:

In the course Mediterranean Biodiversity and ecology students discover the physical characteristics of Mediterranean area and the biodiversity in which it occurs. On the basis of acquired knowledge students can recognize the specificity of the Mediterranean area in Europe and beyond and can understand the importance of space as a major generator of biodiversity in Europe and elsewhere in the world. Students learn about different forms of the Mediterranean landscape and the importance of human performance on its image today's time and past. They learn about the basic factors of land degradation and desertification of the Mediterranean landscape and its impact on biodiversity. They cognize of certain environmental remediation degraded Mediterranean landscape. Students gain a holistic integration of content look at this complex area, because of pronounced multidisciplinary of course, which links some basic knowledge of biology geography, geology, climatology and history. In the context of the course are introduced to different approaches and research methods that will allow them the ability to synthesise and in particular the development of critical thought.

Course name: PLANT PHYSIOLOGY

Number of ECTS credits: 6

Content:

The course is based on acquiring knowledge on plant physiology with an emphasis on biochemical, physical and genetic principles of most important life processes of plants. Within the course the effects of biotic and abiotic environmental factors on plant physiology and stress are discussed. The course is also set to lead students to understand the structure and function, and regulation of processes relevant to morphogenesis, growth and development. The students acquire knowledge on the transport of water and minerals through the plant, the carbon metabolism in plants and other physiological processes in plants. The subject contents include the latest research findings and concepts in plant physiology.

Course name: STATISTICS

Number of ECTS credits: 6

Content:

Statistics has become an indispensable tool in almost all areas of research. Increasingly statistics is also used as a means of streamlining operations and industrial production. Every student need to understand the basic concepts of statistics. The course covers the desired range of statistical concepts and techniques.

General competences acquired by students in this course is to understand the concept of statistical model, understanding the role of statistics in research in other areas as well as understanding the role of statistics in business and industrial processes. In addition the course will prepare the students to proficient graphical methods in data analysis and models for categorical data and analysis time series.

Course name: **ORGANIC CHEMISTRY AND BIOCHEMISTRY**

Number of ECTS credits: **6**

Content:

Students in the course acquainted with the basics of organic chemistry. They gain knowledge of the structure, property and the role of specific organic compounds and their reactivity. Students deepen their knowledge of various types of organic compounds, their structure, reactivity and the possibility of transformation of one organic compounds in the other with focusing on the functionalization of organic compounds. Gain a basic knowledge in the field of organic chemistry, which will serve as the basis for the acquisition of new science knowledge especially in biochemistry. Students learn about the structure, function, biosynthesis and degradation of the major life biomolecules, especially proteins and enzymes. Are able to identify, isolate and quantified biomolecules. Proficient in many techniques, methods and apparatus which are necessary for this. At the same time get insight into the dynamic process of metabolism, the key metabolites in individual metabolic cycles and their interconnection in regulatory mechanisms that maintain cells in a steady state.

If the balance in the cell breaks down for various reasons, it may be a variety of metabolic diseases.

Course name: **INTRODUCTION TO GENETICS AND GENOMICS**

Number of ECTS credits: **6**

Content:

In this course students gain knowledge to understand the basics of genetics and principles of analytical techniques to solve genetic problems. The course provides the basics of formal-, molecular, -population-, quantitative, and evolutionary genetics. Students will understand the logic of genetic experiments, to develop a genetic approach for solving problems and acquire a critical judgment of interaction between genotype and phenotype. By analyzing the opportunities offered by genetics, skills for the application of this knowledge in practice will be developed. Proper selection of methods to achieve the objective will be encouraged. Students will be able to identify targets and seek appropriate solutions with options offered by the knowledge and technology. Laboratory exercises give students the opportunity to learn and implement the basic techniques used in genetics and also to consolidate the theoretical principles presented in lectures.

Course name: **ANIMAL PHYSIOLOGY**

Number of ECTS credits: **6**

Content:

Astounding diversity of animal species on the planet includes a wide variety of their adaptations which they use to cope with the challenges of their environment. Despite their diversity, all animals, from simplest Protista on one side, to vertebrates on the other, they are all relying on similar principles and mechanisms of actions. All animals must maintain a stable internal environment, obtain the necessary nutrients from the outside, eliminate waste products, find a way to exchange

gases and detect happenings in their surroundings and respond appropriately to them. Competencies that students will acquire in this course relate to the question of how physiological processes occur in animals, what have all these processes in common and what are the differences among animal species. Students will also be acquainted with the physiological basis of complex processes such as thinking, behaviour and relationships between the animals and their surroundings. Such knowledge is essential both in terms of general science education, and from the standpoint of understanding of the biodiversity. Students will learn some of the methods used in researches of the animal physiology and compare their usefulness in different animal species. Because the animal physiology is largely interdisciplinary study, students will develop the ability to connect it with other natural science (chemistry, physics), and they will be able to observe processes in nature.

Course name: ECOLOGY

Number of ECTS credits: 6

Content:

The course introduces the basics of ecology in which students learn about the interactions between organisms and in which they influence each other and respond to the environment. Students gain knowledge of internal and external environment of the organism and the ecological environment factors and their effect on living creatures. In this context they get familiar with the minimum principle factors, physiological ecology, optimum, tolerance and adaptation factors. Population ecology gives the classical definition of the base population and the population parameters and leads to understanding population growth and regulation. The next larger set of topics introduce student through absorbing the concepts of niche and competition in ecosystem ecology. Emphasis of Ecosystem ecology is on understanding the (in) stability of ecosystems which in turn leads to awareness of the importance of time scale with which we study the dynamics of ecosystems. In this context, the subject deals with the dynamics (Paleo) ecosystems. Since ecology is often marked as 'scientific or quantitative', the course presents possibilities of experimental ecology.

Course name: CONSERVATION BIOLOGY

Number of ECTS credits: 6

Content:

Conservation biology was developed in response to the rapid extinction of species. This is a new branch of biology that studies the biodiversity and its sustainable use. Its aim is to preserve biodiversity and provide opportunities for further evolutionary change. The course introduces the biodiversity crisis, its extent and causes. This crisis is widely recognized as one of the main threats to the long-term existence of human civilization. The students are presented the limitations of classical nature conservation on one hand, and insight into conservation of small populations and dynamic ecology on the other. The aim is to identify a set of factors (environmental, demographic, genetic, population, etc.), that affect viable population size and trigger extinctions. Students get insight into a set of interdependent processes that operate at different levels, and in the interaction reduce biodiversity. Understanding of processes in small populations allows them to identify main sources of threat to target populations.

Course name: SYSTEMATIC ZOOLOGY

Number of ECTS credits: 6

Content:

The aim of the course is to provide the principles of zoological evolution and systematics of vertebrates and invertebrates. The stress is made upon historical view and methods of classification, taxonomical categories, zoological nomenclature, theory of animal species concepts, and classification and phylogeny of invertebrates and vertebrates.

The students get the basic knowledge of body structure, reproduction, ecology, distribution of given taxa, with some representative species that are represented more in details. Students should know the basics that will help them when approaching to and solving scientific problems. The knowledge in major part is factographical, however, students will be able to develop a critical approach to hypotheses and theories.

Course name: **APPLIED MATHEMATICS IN NATURAL SCIENCE**

Number of ECTS credits: **6**

Content:

Student gain knowledge of mathematical methods used in science. With practical exercises they obtain knowledge of the treated area. Students learn mathematical thinking and get familiar with mathematical language. The course focuses on the following topics: the system of linear equations, matrices, basic operations with matrices, demonstrating vectors in R^3 , equation of planes and lines, sewer and differential, differentiation, Lagrange theorem, extremal problems, Taylor's formula, integral, primitive functions and integrals, NewtonDLeibnizeva formula, differential equations, equations with separable variables, higher order linear equations, functions of several variables. Students will be able to understand the Gaussian method of solving linear equations, understand the concept of matrices and basic operations with them, understand continuity function, derivative of the function and use in the problem solving of extremal account and understanding the concept of the integral and use in addressing the physical and geometric functions.

Course name: **WATER ECOSYSTEMS**

Number of ECTS credits: **6**

Content:

The aim of the course is to provide the basics of limnology and representation of biodiversity in marine and freshwater ecosystems. The imporatnce of water ecosystems for a human being is also explained, including his interactions with these habitats. The course provides the principles and rules of limnology, with stress upon ecology and its biodiversity. Furthermore, the concepts will be shown with examples from scientific literature. The course provides also the interpretation of complex interactions betwwen the human impact and water ecosystem functions, and the ecosystem functions that are very important for us as well as for the conservation of water ecosystems biodiversity.

ELECTIVE COURSES

Course name: **ANATOMY AND HISTOLOGY**

Number of ECTS credits: **6**

Content:

This course is designed to address the organizational diversity of vertebrates by comparing organ systems of lower and higher vertebrates. Students will learn about the morphology of organs in relation to their function. They will learn about the structural development of organ systems, during the embryonic differentiation, and the close association of their function with the ecological conditions that accompanies the development history of vertebrates. In this course students will deal with the structure of vertebrates, functional significance of variations in the structure and the functions of the structures in the geological past. The course aims to provide knowledge of anatomy, physiology and histology to the extent that is sufficient for basic understanding of the structure and function of the human body in comparison with the bodies of

other vertebrates. Students can upgrade the knowledge gained in this class in related courses, which relate to histology, anatomy and physiology.

Course name: CELL AND MOLECULAR BIOLOGY

Number of ECTS credits: 6

Content:

In the course of Molecular and cell biology students will learn and understand the structure of different cell types and based on their structure, the basic operations of each cell type. The student will be also able to critically evaluate the obtained theoretical and practical knowledge of molecular and cell biology and use it in the work environment as well as in research and user environment. Students will acquire the ability to understand other subjects in this area and use the basic vocabulary of the subject matter as a scientific discipline in Slovenian and foreign language (English).

Course name: EVOLUTION BIOLOGY

Number of ECTS credits: 6

Content:

Students will be acquainted with the fundamentals of evolutionary biology as a universal concept on which is based the biological science. Throughout the history of the development of evolutionary thought come to the Darwinian evolution, which was later accompanied by the development of modern neo - Darwinists. During the tense confrontations between evolutionism - creationism students can understand the importance of evolution for the modern biology, due to the role it plays in the formulation of hypotheses and their testing. The course is aimed at understanding the foundations of Darwinian evolution (spontaneous variation - selection), participants are introduced to the basic hypothesis of the creation of life. The course introduces the basic concept of connectivity of modern biology, in the light of evolutionary biology. This course will allow the students the understanding of fundamental mechanisms of change and adaptation of the living world. The relatively high proportion of independent work is aimed at promoting and developing critical diverse biological interpretations of the facts in the light of evolution biology, which can be achieved by self-studying and presenting and defending the conclusions in the form of seminars.

Course name: ENVIRONMENTAL MONITORING

Number of ECTS credits: 6

Content:

The course aims to acquaint students with the basic principles of chemical analysis. Course apply knowledge of the design, manufacture and application of modern measurement techniques and instruments in environmental monitoring.

Students deepen the knowledge of fundamental chemical principles and learn the basic analytical techniques used in determining the status of environment. At lectures students acquire theoretical knowledge, which can be upgraded to professional practice in the context of computational and laboratory exercises. Emphasis is placed on the correct analysis of the samples, their preparation for the measurement (solution or direct analysis of solid samples), and statistical processing of the results by checking the accuracy.

By addressing key problems in the course, students become familiar with various research methods and techniques that will allow them to deepen and acquire new knowledge, develop critical thinking and the ability to synthesise and apply acquired knowledge and skills in practice.

Course name: GIS AND INTRODUCTION TO THEMATIC CARTOGRAPHY

Number of ECTS credits: 6

Content:

This course acquaints students with methods to solve geographic problems by using geographic information systems (further GIS) and the visualization of results. The introduction of organization of GIS has also been upgraded with more specific approaches to the spatial analysis. Major emphasis is given to the nature, capturing, processing and accuracy of spatial data, because the knowledge on their structures is of the utmost importance for the correct approach to solving the set of problems. For the students to be able to properly present the results of geographical research to other users is very important that they become familiar with the general laws of production of the thematic maps. In addition to the mathematical elements of maps and cartographic generalization, students will learn about appropriate ways of the cartographic design expressions.

Course name: MARINE BIODIVERSITY

Number of ECTS credits: 6

Content:

The course provides students with knowledge on biodiversity of world wide oceans and seas and explanation of factors that influence on biodiversity. Students get familiar with benthic bionomy of the Mediterranean Sea, with stress upon the Adriatic Sea. The course also provides the basic characteristics and specialities of the Mediterranean and Adriatic fauna and flora. Recent changes in sea biodiversity that are consequence of global oceanographic and climate changes, and the antropogenic influence (bioinvasion, mariculture, epibiosis).

Course name: MANAGEMENT OF PROTECTED AREAS AND SUSTAINABLE USE

Number of ECTS credits: 6

Content:

Protected areas are the most important instrument of protection of biodiversity and can significantly contribute to the socio-economically developing regions. Protected areas can achieve their objectives only if they are linked in a comprehensive and effective system. Such a system must be adequately supported by legal and sectoral basis, guaranteed and should be in the proper management of protected areas and sustainable funding.

Students are acquainted with the subject of the historical origins of protected areas in the world and Slovenia, they learn about the international categorization of protected areas. To understand the importance of their management they become familiar with different methods and approaches to the management of protected areas and legal issues and the situation in Slovenia, including the procedures for the designation of protected areas.

Course name: SYSTEMATISATION, STANDARDISATION OF QUALITY AND PATENT LAW

Number of ECTS credits: 6

Content:

The course is dedicated to the presentation of systems of patent protection, with emphasis on the protection of inventions, biological material and genetic resources, which, with the development of modern technologies such as biotechnology and modern biotechnology in particular, is becoming increasingly important topic in relation to decisions on the patentability of inventions. The goal of this course is a comprehensive presentation of the scope of patent protection, with the emphasis on the protection of biological material and genetic resources. Students will be in this course acquainted with the national and international system of patent protection, knowledge of which is

crucial for understanding and enforcement of patent rights in different areas. They will be presented with the aspect of the use of patent literature, the use of various databases and other resources that are important for determining the state of technique, which is one of the key criteria for the granting of rights. Knowledge on how to prepare a patent application and when an idea can become an invention, students will gain by the preparation of seminars and by using interactive approaches to specific cases in order to increase innovation among students.

Course name: **STATISTICAL METHODS IN GIS**

Number of ECTS credits: **6**

Content:

Students will learn the basics of spatial statistics, its evolution, strengths and weaknesses, the difference between it and the usual statistics and the use of its basic methods and computer programs, which are used for its application. They will learn about the inevitability of the use of quantitative methods in geography. In addition to basic principles they will acquire the knowledge about advanced static methods, with greater emphasis on the point and continuous events in the sampling. The acquired knowledge will allow them to do quantitative analysis of mass phenomena, which are the starting point for many, especially the socio-geographic researches. Students will put this knowledge to good use at work in many other courses, but they will also come in handy in the analyses carried out for seminar and master thesis.

Course name: **BIOGEOGRAPHY**

Number of ECTS credits: **6**

Content:

During lectures of the subject Biogeography students learn basic principles of distribution of diversity of life on earth surface and about processes and the historical and current ecological conditions that affect the distribution of species and communities. Students are acquainted about some of the leading hypotheses, which permit them to create separate hypotheses of observed phenomena. Students are also introduced to the fundamental principles of research work in biogeography, from descriptive to experimental, such as a various molecular techniques and the use of geographic information systems, allowing independent work while monitoring relevant scientific literature. During field courses students learn the characteristics of the Mediterranean biogeographical region and of the Balkan Peninsula.

Course name: **LIMNOLOGY**

Number of ECTS credits: **6**

Content:

In the lectures of the course of Limnology students learn the basic characteristics of water as a substance and its global distribution and circulation, and various forms of freshwater ecosystems. In following lectures they gain knowledge of the lighting and thermal conditions in inland waters: permeation and absorption of light in water, heat distribution in the rivers and lakes. They are presented with the annual dynamics of water circulation in lakes and water movement in rivers. Students also learn about food chains in freshwater ecosystems and the links between their articles. Here, students focus on the chemical characteristics of inland waters and on the different distribution of dissolved oxygen in the running and standing waters in oligotrophic and eutrophic lakes, the salinity of inland waters. Students understand the concept of carbonate equilibrium and learn about the circulation of the main elements in rivers and lakes. They acquaint with plankton communities and their interactions, and interactions between land and water. Students learn about the composition of the sediments, organisms and processes conducted there. It also presents the

benthic and fish communities. In the final part of the course are presented in ontogeny of inland water ecosystems and briefly paleolimnology and its importance.

Course name: ECOTOXICOLOGY

Number of ECTS credits: 6

Content:

The course is devoted to the presentation of ecotoxicology and methods which provide high quality environmental risk assessment of chemicals. Ecotoxicology is presented in the narrow sense as a science that studies the harmful effects of chemicals on ecosystems, unlike toxicology, which pays full attention to studying the effects of individual substances in humans.

The aim of this course is to present the impact of chemicals on various ecosystems, the determination of the damage and ways to improve the situation and the prevention of further injury. Knowledge gain in the course enables students to understand the dynamics and biological balance of natural and artificially induced changes in the nature / environment, resulting from the impact of human activity in the use of chemicals. Attention is directed to find and common sense principles and methods in both science and the specificity of each of them. The topic ecology provides students with the basics of ecology knowledge. The emphasis is on understanding the importance of communities, population dynamics and genetics of populations in the evaluation of potential environmental effects of chemicals. Knowledge of toxicology is limited to the basic principles and methods. Students are also presented with inport of chemicals into the organism, the receipt and distribution of substances in various tissues in the body, metabolism and excretion from the organism.

Course name: BIODIVERSITY OF CULTURAL PLANTS

Number of ECTS credits: 6

Content:

Students get familiar with basic environmental requirements for each fruit species and with the role of various organs of fruit plants. Developmental stages of fruit trees, phenology, bases of bud differentiations and climatic factors that affect these processes are presented. During the vineyard work, students get acquainted with wine as an agricultural industry in the USA and the EU with its strengths and limitations. Students learn about the basic climate conditions that are necessary for successful cultivation of vine. From a technological perspective they evaluate the viability of vine cultivation in Mediterranean region. During the horticultural part of the subject the students get familiar with different types of vegetables with an emphasis on morphological and selection objectives for each species and their environmental growing requirements. In practical exercises the student is informed primarily by organography of fruit plants and vines. Students learn about different rootstock and basics of pruning. They get acquainted with the morphological differences and types of vegetables and their production technology.

Course name: HYDROLOGY BASICS AND WATER PROTECTION

Number of ECTS credits: 6

Content:

Students will be acquainted with the basic geological processes, the formation and development of land, the main properties and processes in the soil, the production capacity and the evaluation of the soil, the selection of the appropriate measures to improve the natural resources of soil, but also the human impact on soil and the environment pollution. It is important for the biology and geography

students that, in addition to agronomists, foresters, and landscape architects, obtain the knowledge about soils.

In particular, some types of land use (agriculture, recreation...) are seen as specific threat, in terms of nature conservation and biodiversity, so it is very important that the student receives a broad and detailed knowledge of the soils. Due to the increasing pollution from various sources, the student will acquire knowledge and experience how to identify the areas of lands suitable for various uses of the abandoned and degraded areas, as well as the alternative solutions for the future use. Land use and land conservation is becoming an increasingly important part of sustainable management of natural resources.

Course name: **PROBABILITY**

Number of ECTS credits: **6**

Content:

Fundamentals of combinatorics

- Fundamental Theorem of combinatorics.
- Variations with repetition and variation.
- Combinations and combinations with repetition.
- Permutations and permutation with repetition.
- The binomial formula and generalizations.

Results and Events

- The set of all possible outcomes, events, definition of probability.
- Calculation of the events.
- Conditional probability and independence.

Random variables

- Random variables and their distributions.
- Review of basic discrete distribution.
- Mathematical expectation and variance.
- Continuous random variables.

Multi-dimensional distribution

- Definition of multi-dimensional discrete distribution.
- Independence of random variables.
- Covariance, the sum of random variables.
- Conditional distributions and conditional mathematical hopes.
- Multi-dimensional continuous distributions.

Generating functions

- Definition and examples.
- The process of diversification.
- Approximation of distributions.
- Convergence in distribution of random variables.
- Normal distribution approximation of sums of random variables.
- Poisson approximation.

Course name: **ECONOMICS OF AGRICULTURE AND ENVIRONMENT**

Number of ECTS credits: **6**

Content:

The course aims to introduce students to economics of agriculture as a separate branch of economic theory, which in level of farms, business and agricultural markets settles and predicts the theoretical and practical issues of the development of agriculture. The course introduces students to a comprehensive treatment of basic economic concepts that are used in analysis of the economic

characteristics and economic conditions in agriculture. They will learn about the economic characteristics and laws of protection and utilization of limited natural resources and free and will get ready to critically evaluate the costs and benefits that affect the environment, and will gain further understanding of economic aspects of the interaction between agricultural production and natural environment. The acquired knowledge will provide a possibility for critical assessment of political and economic decisions in agriculture.

Course name: BIOLOGICAL TOPICS IN ENGLISH

Number of ECTS credits: 6

Content:

Lectures will discuss the concepts in various fields of life sciences. The first part of the course will focus on cellular and molecular biology, human physiology / pathophysiology and neuropathology in terms of systems biology and bioinformatics. Students will get a broad insight into macromolecules such as DNA, proteins and their functions, regulation of gene expression in prokaryotes and eukaryotes, biotechnology and cloning. Featured will be a critical cellular processes such as transmembrane transport, cell cycle and signaling. Development of diseases such as cancer, on the one hand, and neurological diseases, on the other hand, will serve as working examples where these processes are no longer in equilibrium.

The second part of the course will cover the evolution, with particular emphasis on the concepts that led to Darwin's thinking. Organic part of the course will also include a network of life, biodiversity and living fossils. Lectures will be closed to marine biology and nature conservation. Seminar of the course will include practical skills such as reading and writing articles and preparing presentations in science.

Course name: EVOLUTION GENETICS

Number of ECTS credits: 6

Content:

The aim of this course is to introduce students to the basic concepts of evolutionary genetics and deepen their knowledge about the usefulness of molecular tools determining evolutionary history of species. Students will acquire more detailed insight into the molecular basis of variability of living things, patterns and mechanisms of change of biological macromolecules, molecular phylogenetics, and gene evolution. Other acquired competences relate to a synoptic knowledge of evolutionary theory and mathematical representation of basic microevolutionary events. Students will be able to understand specifics of molecular evolution and application of bioinformatics into molecular evolution and phylogenetics. Lectures will provide theoretical knowledge, which will be upgraded in the tutorials with practical computational exercises and case-studies. By addressing key problems in the course the students will learn different research methods and techniques that will allow them to acquire new skills and develop critical thinking.

Course name: BIOINFORMATICS

Number of ECTS credits: 6

Content:

The first part of the Bioinformatics course will include the presentation of the language and structure /function of biological macromolecules, the genetic code, and bioinformatics tools for analysis and prediction of protein structures and functions. Also, microchips, biomarkers, high throughput -omics studies and techniques required for the analysis of macromolecules will be also presented. Topics will also include bioinformatics databases and tools in the field of molecular / cellular research study of macromolecules. Knowledge acquired by students will be practically applied to the analysis of a single gene, mRNA, protein, and they will be able to put them in a cell signalling pathway in cell physiology and pathology of the potential of the organism. The second part of the lectures will be

devoted to addressing some of the basic algorithmic principles underlying the development of modern bioinformatics tools. It will include methods for the analysis and alignment of nucleotide and protein sequences, methods for analysis of gene expression and methods for reconstructing phylogenetic trees. Various algorithms for finding patterns in text and associated data structures, as well as many dynamic programming algorithms will be presented. The knowledge gained in this course will be useful for any problem associated with genes, proteins or organisms with an emphasis on obtaining information and data analysis.

Course name: INTRODUCTION TO DATABASE SYSTEMS

Number of ECTS credits: 6

Content:

Logical data models. Entity-Relationship Model. Relational model. Translation of ER to relational model. Relational algebra and calculus. SQL standard. SQL version 3. QBE. Implementation of SUPB. Discs and files . Memory SUPB system. Index file. Indices: ISAM, B + trees and hash indices. Algorithms for evaluating relational operations. Optimizing queries. applications data bases. Embedded SQL. JDBC and SQLJ. Stored procedures and functions.

Course name: INFORMATION TECHNOLOGY MANAGEMENT

Number of ECTS credits: 6

Content:

Information technology and organization. Bases of information society. The impact of information technology on decision making and evaluating decisions in the organization. Virtual organizations and modern basics of the theory of virtual organizations. Switching principle and metamanagement.

- Computerised information systems and systems to support decision making. Basics of e-commerce. Web technologies in the business and administrative environment. The basic architecture of information systems. Computerised decision support systems in business and administrative environment. Outsourcing information services. Case studies.
- Systematic approach in the designing of information systems. Structuring and modeling of information systems. The design of information systems. System analysis. Information technology and reengineering of organizational processes.
- Special Topics in Information Engineering and case studies. Virtual (fictitious) company. Examples of information systems in practice. Use of information technology and multimedia systems in education.

Course name: BASIC POPULATION GENETICS

Number of ECTS credits: 6

Content:

The purpose of this course is to familiarize students with basic aspects of population genetics and molecular tools for studying populations of plants and animals. We will discuss ways of measuring the diversity of populations (heterozygosity, distribution and allele frequencies, genotypes) and the factors affecting the diversity of the population (selection, genetic drift, mutation, gene flow). Students will also be introduced to formation of populations and their structure in space. Special emphasis will be put on the use of genetics in species conservation. Part of the contents will be devoted to molecular population genetics, and will discuss sequence divergence, amino acid substitutions, nucleotide substitutions, molecular clock, intraspecific polymorphism and non-coding sequence polymorphism. Within the seminar the practical aspect of population genetics will be introduced. This includes the use of specific statistical methods and solving simple problems of quantitative population genetics. Additional knowledge will be acquired during the preparation and presentation of seminars based on scientific literature.