Courses taught in foreign languages in academic year 2019/20

Content

Further courses are available based on individual consultation upon arrival.

DEPARTMENT OF BIOLOGY

Faculty/Institute:	Faculty of Science / Department of Biology
Course title:	**Behavior – introduction to ethology, behavioral ecology and sociobiology**
Course code:	KBI / E117
ECTS:	5
Level of course:	Bachelor + master
Teacher:	RNDr. Eva Jozífková, Ph.D.
Term:	Winter + Summer
Language of instruction:	English
Lectures/exercises:	1/1 per week
Completion:	Exam
Course goal:	Introduction to ethology, Behavioral Ecology and Sociobiology, basic terms, and principles connected to the behaviour at these fields of study with examples explaining both animal and human behaviour. (The chapters containing human ethology and evolutionary psychology are included.)
Abstract:	1. The roots of ethology, behavioral ecology and sociobiology Tinbergen´s four questions, ultimative and proximative causation 2. Adaptation, fitness, fitness cost x benefits, strategy, tactics, heredity of behaviour, altruism 3. Ethology: Lorenz, Tinbergen, von Frisch, ethology terms 4. Neural x humoral regulation, decision making, aggression 5. Social behaviour, hierarchy, 6. Social systems, mating systems 7. Sexual behavior, alternative reproduction strategy parent-parent conflict 8. Parental behaviour, parental investment, parent-offspring conflict, offspring – offspring conflict, helpers, infanticide, sex ratio 9. Maintenance behavior I. 10. Maintenance behavior II. 11. Signals and communication 12. Ontogeny, play, learning, memory, nurture versus nature, personality 13. Normality and “abnormal behaviour”, human ethology 14. Evolutionary psychology

Faculty/Institute:	Faculty of Science / Department of Biology
Course title:	**Mammalogy**
Course code:	KBI / E118
ECTS:	5
Level of course:	Bachelor + Master
Teacher:	RNDr. Eva Jozífková, Ph.D.
Term:	Winter + Summer
Language of instruction:	English
Lectures/exercises:	1/1 per week
Completion:	Exam
Course goal:	Taxonomy, phylogeny, anatomy, and morphology of mammals in relation with their ecology and behaviour. (Practices: examples of animal life strategies; non-invasive observation - telemetry, camera trap, batdetector, taxidermy animals; skulls x bones).
Abstract:	1. Introduction 2. Origins, characteristics, classifications 3. Monotremata; Metatheria - introduction 4. Metatheria: Didelpimorphia, Paucituberculata, Microbiotheria 5. Notoryctemorphia, Dasyuromorphia, Peramelemorphia, Diprotodontia Tubulidentata, Sirenia, 6. Afrosoricida, Macroscelidea, Hyracoidea, Proboscidea, Xenarthra (Edentata), Scandentia 7. Dermoptera, Primates, Rodentia, 8. Lagomorpha, Insenctivora, Chiroptera, 9. Pholidota, Carnivora, Cetacea, 10. Perissodactyla, Arthrodactyla 11. Reproduction, physiology, echolocation 12. Eecology, zoogeography 13. Behavior 14. Conservation ethics, disease and zoonoses)

Faculty/Institute:	Faculty of Science / Department of Biology
Course title:	**Plant Physiology**
Course code:	KBI / E103
ECTS:	7
Level of course:	bachelor
Teacher:	Mgr. Hana Malinská, Ph.D.
Term:	Winter
Language of instruction:	English
Lectures/exercises:	8/12 per semester
Completion:	exam
Course goal:	The main goal of this subject is to introduce students in the basic principles of plant physiology. An attention will be paid to the connection of plant morphology, physiology, the function of individual types of plant tissues, the molecular biology background of processes in plant cell and molecular base of the most important physiological processes in plant. The course has two forms - theoretical as well as practical. During the practical part, students will be trained in the basic methods of plant physiological studies.
Abstract:	1. Basic structure and function of the plant cell 2. Elementary composition and metabolism of plant cell 3. Water regime of plants 4. Mineral nutrition of plants 5. Photosynthesis - primary processes 6. Photosynthesis - secondary processes 7. Respiration of plants 8. Transport of assimilates. Heterotrophic nutrition of plants 9. Growth and development of plants - growth regulators 10. External factors of plant growth and plant development 11. Physiology of seed germination, flower, fruit, seed and tuber development 12. Dormancy and senescence of plants. Plant movement. 13. Plant tissue cultures 14. Physiology of plant stress 15. Genetic determination of physiological process

Faculty/Institute:	Faculty of Science / Department of Biology
Course title:	**General of Parasitology**
Course code:	KBI / E104
ECTS:	7
Level of course:	bachelor
Teacher:	Mgr. Karina Vašínová, Ph.D.,
Term:	Winter semester
Language of instruction:	English
Lectures/exercises:	2/2 per week
Completion:	exam
Course goal:	The parasitology belongs into the important biological fields. These lectures are concentred on the general characteristic of parasites, parasitology as field, parasite-host interactions and their biology and ecology. There is also includes the basic systematic classification of parasites and characteristic of the main taxonomic groups (protozoans, helminths and parasitic arthropods), special parts are apply to the most important diseases caused by parasites (toxoplasmosis, malaria, encephalitidis, etc.).
Abstract:	1. Introduction to the parasitology, syllabus and recommended literature 2. The general parasitology - part I (terminology, definition of parasites, hosts and environment, classification of parasites) 3. The general parasitology - part II (life cycles, immunology, parasites and immunity) 4. Protozoology I (characteristic of protozoans, trypanosomosis, leishmaniosis) 5. Protozoology II (trichomoniasis, giardiosis, amoebiasis) 6. Protozoology III (coccidiosis, toxoplasmosis, malaria, balantidiosis) 7. Helminthology I (characteristic of helminths, intestinal trematode) 8. Helminthology II (fasciolosis, dicrocoeliosis, paragonimosis, intestinal cestoid, taeniae) 9. Helminthology III (hymenolepiosis, nematode worms, trichuriosis) 10. Helminthology IV (trichinellosis, ascariosis, enterobiosis, tropical filariosis) 11. Arachnoenthomology I (characteristic of parasitic arthropoda and acarid) 12. Arachnoenthomology II (parasitic insects, lice, kissing bug, dipterous, chigger and flea) 13. Discussion and conclusion

Faculty/Institute:	Faculty of Science / Department of Biology
Course title:	**General Zoology**
Course code:	KBI/E105
ECTS:	7
Level of course:	bachelor
Teacher:	Mgr. Michaela Liegertová, Ph.D.
Term:	Winter/Summer
Language of instruction:	English
Lectures/exercises:	2/3 per week
Completion:	exam
Course goal:	The aim is to provide information on common properties of animals, including structure, metabolism and function of cells and tissues of the organism as well the principles of reproduction of animals. Principles and practical exercising of the selected classic and modern cytological and biotechnological methods are included.
Abstract:	The Course includes lectures and lab sessions divided in 4 blocks. Lectures are focused on general biology of animal cells and tissues and principles of reproduction of animals. During lab sessions students will be introduced to classic and the contemporary methods used for studies of cells and tissues, incl. principles of biotechnologies. Students will work with actual cell and tissue microscopic specimens both at light and electron-microscopy levels as well PC interactive programs. Knowledge of basic chemistry of life from previous Courses is supposed. <u>Block 1: Structure and function of the animal organism and the cell</u> Molecular architectonics of biomembranes and membrane organelles Cytoskeleton, its chemistry and structure Cell nucleus, its chemistry and fine structure Cytosol and its molecular composition <u>Block 2: Cell functioning</u> Transport of molecules between cells and the extracellular milieu Cell energetics and protein synthesis Cell signalling and interactions Cell division and its regulation Cell differentiation and gene expression Cell damage, the defence mechanisms and cell death <u>Block 3: Structure and function of animal tissues</u> The cells and extracellular matrix, their characteristics and common structural and molecular features. Classification of animal tissues and their incidence in the animal body organs. <u>Block 4:Reproduction of animals</u> Gametogenesis Fertilization Blastogenesis

Faculty/Institute:	Faculty of Science / Department of Biology
Course title:	**Animal and Human Physiology**
Course code:	KBI / E106
ECTS:	7
Level of course:	bachelor
Teacher:	doc. MUDr. Vladislav Mareš, DrSc.,
Term:	Winter semester
Language of instruction:	English
Lectures/exercises:	2/3 per week
Completion:	exam
Course goal:	The aim is to provide information on function of organs and their systems in various animal species and man with special attention to the integrative role of the nervous, endocrine and immune systems. Principles and exercising of basic laboratory techniques for functional monitoring of selected organs by real and simulation approaches are included.
Abstract:	The course deals with basic functions of animals with special accent on mammals. The Course is divided into 9 lecture and lab session blocks. Previous knowledge of cell and tissue structure and functioning (General Zoology Course) is necessary. Block 1: Animal body organs, their functional hierarchy and integration. Homeostasis. Block 2: Irritability, excitability and integrative function of the nervous system Physiology of neuron (action potential, synaptic transmission, neuronal networks). Phylogenetic and comparative aspects of the nervous system. Functional anatomy of vertebrate spinal cord and brain incl. man. Peripheral nerves and their function. Somatic and autonomic regulations. Sensoric functions. Higher nervous activity Block 3: Body motorics Functional morphology of skeletal and smooth muscle cells Motor units. Types of muscle contraction. The main groups of body muscles and their functioning. Types of movement. Mechanisms of the voluntary movement Block 4: Hormonal regulations Signalling molecules, their classification and receptors. Transduction and intracellular propagation of hormonal signals. Hormones and the feedback regulation of their levels. Endocrine glands and their specific hormones. Phylogenetic and comparative aspects of endocrines regulations. Hormonal regulation of metabolism, growth and reproduction. Growth Factors, their sources and effects. Stress and the General Adaptation Syndrome. Block 5: Immune reactions and functional morphology of the immune system Immune reaction cells and molecules. Non-specific and specific immunity. Primary and secondary immune organs. Humoral and T-cell mediated immunity. Immune diseases (AIDS, allergies, infertility etc). Block 6: Metabolism, nutrition and excretion Metabolic pathways and intermediary metabolism. Basal metabolism. Food intake and functional morphology of gastrointestinal system. Phylogenetic and comparative aspects. Functional morphology of kidneys. Phylogenetic and comparative aspects of excretory functions Block 7: Blood circulation and respiration Phylogenetic and comparative aspects. Functional morphology of heart and

	circulation system. Blood pressure and its regulation. Blood and extracellular fluid. Respiration in air and water medium. Transport of gasses. Regulation of respiration. Block 8: Thermoregulation and biorhythms The energy sources and expenditure. Shaking and non-shaking thermoregulation. Seasonal, diurnal and circahorial rhythms and their generation in the body and cells Block 9: Reproduction Gametogenesis and fertilization. Phylogenetic and comparative aspects. Sexual behaviour. Hormonal and nervous regulation mechanisms. Principles of anticonception

Faculty/Institute:	Faculty of Science / Department of Biology
Course title:	**Ecology**
Course code:	KBI / E107
ECTS:	7
Level of course:	bachelor
Teacher:	Mgr. Karina Vašínová, Ph.D.,
Term:	Summer semester
Language of instruction:	English
Lectures/exercises:	2/1 per week
Completion:	exam
Course goal:	The ecology is the science about the interactions among living organism and their environment. This subject is concentred on the characteristics of the environment of living organism, ecological factors (abiotics x biotics). The ecology of populations, synecology, aquatic and landscape ecology are the major subjects of these lectures. Other topics include the study of biodiversity, ecosystem, other parts of biosphere and the relationship between man and the biosphere.
Abstract:	1. Introduction to the ecology, syllabus and recommended literature 2. Terminology, definition of ecology, biotic and abiotic environment, classification of factors, field and subject of ecology 3. Organism and his environment, adaptation, divergence and convergence, nomenclature and terminology 4. Ecological factors (abiotics x biotics), climate and clime, classification and characteristic of biomes 5. Territory such as source, special forms of nutrition 6. Ecological characteristic of atmosphere, hydrosphere and pedosphere 7. Interactions among living organism and their environment, characteristics of the environment of living organism 8. The ecology of populations, density, distribution, structure, natality and mortality, migration, population dynamics 9. The ecology of guilds, synecology, density, abundance, production, dominance, presence and absence, other characteristic 10. Interspecific and intraspecific interactions among living organism 11. The study of ecosystem, other parts of biosphere and the relationship between man and the biosphere 12. The study of biodiversity, diversity index 13. Discussion and conclusion

Faculty/Institute:	Faculty of Science / Department of Biology
Course title:	**Microfluidic systems in bioanalytical applications**
Course code:	KBI /E108
ECTS:	7
Level of course:	bachelor
Teacher:	Mgr. Marcel Štofik, Ph.D.
Term:	Summer semester
Language of instruction:	English
Lectures/exercises:	0/3 per week
Completion:	exam
Course goal:	The course is designed for students of biological sciences. The aim of the course is to introduce students to the issues of microfluidic devices for analytical and bioanalytical purposes in the biological sciences.
Abstract:	The theoretical part of the course informs students about the history of microfluidic systems development and their potential in biological and biochemical analyses. Students will be introduced to the fundamental principles of microfluidic devices and to the main methods of their design. The main issues of the theoretical part are as follows: -History of microfluidic systems and their development - ?TAS systems, Lab-on-a-chip, BioMEMS - Fundamentals of physical principles of fluid mechanics in small scaled devices - The design technology and the materials for the preparation of microfluidic devices - Selected fields of use of microfluidic systems in biological applications The practical part is focused on specific design protocols and simple biological analyses by means of a prepared device. Laboratory protocols will be focused on the following working procedures: - Preparation of graphical designs of masks for UV lithography with graphics software - Preparation of substrates - substrates for fabrication of masks for UV-lithography. Chemical and ultrasonic cleaning. - Preparation of thin layers by sputtering method - preparation of seed layers and masks for electron beam lithography and UV-lithography, preparation of electrodes for electrochemical analysis. - Electron beam lithography - preparation of masks for UV-lithography using positive and negative resists. - UV lithography - preparation of masks for dry and wet etching and galvanic deposition, preparation of molds for soft lithography, microchannels fabrication. Positive and negative resists will be used. - Soft lithography - PDMS (polydimethylsiloxane) casting - Completion of the microfluidic device design - setting connectors and tubes on the device and connecting it to a detection device - Analysis - a simple electrochemical or optical sample analysis in a prepared device will be performed

Faculty/Institute:	Faculty of Science / Department of Biology
Course title:	**Molecular and Cell Biology**
Course code:	KBI / E111
ECTS:	7
Level of course:	Bachelor + Master
Teacher:	Mgr. Michaela Liegertová, Ph.D.
Term:	Winter + Summer
Language of instruction:	English
Lectures/exercises:	2/2 per week
Completion:	exam
Course goal:	The main goal of this course is to introduce students into molecular basis of life. Students will learn about synthesis and transformation of biomolecules within the cell. About the connection between the structure of the molecule and its function in living cell. During the course we will also introduce basic molecular methods.
Abstract:	1. Structure and function of proteins 2. Structure and function of nucleic acids 3. Genetic code, tRNA 4. Translation 5. Postranslation modifications, transport and degradation of proteins 6. Transcription of prokaryotes. Regulation of gene expression through transcription 7. Replication of DNA. Plasmids 8. Postreplication modification of DNA 9. Structure of eukaryotic genome 10. Transcription of eukaryotes 11. Splicing and other postranscription modifications 12. Transposons 13. Viruses and bacteriophages

Faculty/Institute:	Faculty of Science / Department of Biology
Course title:	**Mycology**
Course code:	KBI / E112
ECTS:	5
Level of course:	Master
Teacher:	doc. RNDr. Milan Gryndler, CSc
Term:	Summer
Language of instruction:	English
Lectures/exercises:	2/0 per week
Completion:	Exam
Course goal:	Status of Fungi and fungus-like members of Protozoa and Chromista. General characteristics incl. morphology, biology and phylogeny of these groups are given. The basic terminology is explained and a new literature on this field is demonstrated. The systematic treatment of main groups (phyla/divisions, classes, orders and their representatives), their ecology and significance in phytopathology, medicine, health service or biotechnology is given. The theoretical knowledge by the practical training is supplemented.
Abstract:	1. Status and characteristics of fungi and fungus-like members of kingdoms Protozoa and Chromista. Kingdom Protozoa: Acrasiomycota (acrasid cellular slime molds) - general characters, life cycle, morphology, ecology and occurrence in nature. 2. Myxomycota (true slime molds) - sexual and asexual development, morphology and morphogenesis, life cycle and the nuclear relations, ecology and occurrence in nature. Plasmodiophoromycota endoparasitic slime molds) - life cycle, characteristics, nuclear relations, occurrence and importance. 3. Kingdom Chromista: Labyrinthulomycota (net slime molds) - life cycle, zoospore ultrastructure, ecology and occurrence in nature. Peronosporomycota - life cycle, characteristics, systematic treatment, zoospore ultrastructure, occurrence and importance. Hyphochytriomycota - life cycle, morphology and development, occurrence in nature. 4. Kingdom Fungi. Chytridiomycota - systematic treatment, reproduction, life cycle, morphology, zoospore ultrastructure, ecology and occurrence in nature. 5. Zygomycota - life cycle, systematic treatment, development of zygosporangium, morphology of asexual reproduction, ecology and occurrence in nature. 6. Microsporidiomycota - life cycle, morphology, ecology and occurrence in nature. 7. Ascomycota - general characteristic, life cycle, teleomorph - anamorph concept, systematic treatment. Taphrinomycetes, Saccharomycetes and Laboulbeniomycetes - systematic position, morphology, life cycle, ecology, importance and occurrence in nature. 8. Eurotiomycetes, Pezizomycetes, Leotiomycetes, Orbiliomycetes - systematic treatment, morphology, ecology, importance and occurrence in nature. 9. Spathulosporomycetes, Sordariomycetes - systematic treatment, morphology, ecology, importance and occurrence in nature. Lichenised classes Lecanoromycetes and Arthoniomycetes briefly mentioned. 10. Chaetothyriomycetes, Dothideomycetes - systematic treatment, morphology, ecology, importance and occurrence in nature. Deuteromycetes - delimitation, morphology, significance in nature and for professional users. 11. Basidiomycota - general characteristic, life cycle, comparison with Ascomycota. Urediniomycetes, Ustilaginomycetes systematic treatment, morphology, ecology, importance and occurrence in nature. 12. Agaricomycetes - systematic treatment, morphology, ecology, importance and occurrence in nature.

Faculty/Institute:	Faculty of Science / Department of Biology
Course title:	**Application of Methods of Molecular Genetics in Studies of Microbial Communities**
Course code:	KBI / E113
ECTS:	5
Level of course:	Master
Teacher:	doc. RNDr. Milan Gryndler, CSc
Term:	Summer
Language of instruction:	English
Lectures/exercises:	1/1 per week
Completion:	Exam
Course goal:	Microbial communities (in soil, in sediments, in composts, etc.) often show high taxonomic diversity and can be studied using various cultivation or molecular methods. The problem connected with application of cultivation methods consists in strong preference for detection of easily culturable microorganisms, while slow growing ones, or these producing small amounts of propagules, are not efficiently detected and unculturable organisms cannot be detected at all. Molecular detection methods are independent on culturability of the microorganisms because they detect DNA from different microbial taxa. The course will provide the basic training in most common molecular methods. Their advantages and limitations will be discussed and practical application protocols will be given.
Abstract:	1) Introduction: good laboratory practice in molecular genetics, designing the experiments 2) Laboratory exercise 1 - Good laboratory practice 3) Extraction and purification of DNA from microbial cultures (theory), polymerase chain reaction (PCR) use in molecular genetic detection methods (theory), selective DNA primers 4) Laboratory exercise 2 - Extraction and purification of environmental and microbial DNA, PCR 5) Purification of the PCR products, gel electrophoresis, restriction cleavage (theory), gradient gel electrophoresis DGGE and TGGE 6) Laboratory exercise 3 - Purification of the PCR products, gel electrophoresis 7) Methods of the amplicon analysis: RFLP, T-RFLP, RAPD. Ligation of DNA fragments, AFLP 8) Laboratory exercise 4 - Restriction analysis 9) DNA sequencing: Sanger sequencing and high-throughput sequencing methods. The use of sequencing methods in the identification of microorganisms 10) Analysis of sequencing data in microbial ecology 11) Molecular cloning, cloning vectors, heterologous gene expression, expression vectors for E. coli and yeasts. 12) Examples of molecular genetic analysis of microbial communities I. 13) Examples of molecular genetic analysis of microbial communities II.

Faculty/Institute:	Faculty of Science / Department of Biology
Course title:	**Introduction to Scanning Electron Microscopy in Biology**
Course code:	KBI / E114
ECTS:	5
Level of course:	Master
Teacher:	RNDr. Oldřich Benada, CSc.
Term:	Summer
Language of instruction:	English
Lectures/exercises:	2/0 per week
Completion:	Exam
Course goal:	Students should learn the basic differences between transmission and scanning electron microscopes and the technique of digital image recording in TEM and SEM, image processing and archiving of image data sets. Students also should get theoretical knowledge of biological sample preparation for TEM and SEM and also pass through some practical training in preparation of selected samples for electron microscopy
Abstract:	The first part of the course will be devoted to acquiring fundamental information and skills in Transmission Electron Microscopy (TEM) and Scanning Electron Microscopy (SEM) in biology. The second part will include sample preparation techniques and methods used in biological electron microscopy. The third part will include the strategies of device optimization and image data recording in TEM and SEM. An image data storing and processing will be discussed as well. Based on the above mentioned skills each student will choose a project to complete and submit formal written and oral reports of their findings.

Faculty/Institute:	Faculty of Science / Department of Biology
Course title:	**Plant Biotechnology**
Course code:	KBI / E115
ECTS:	7
Level of course:	Master
Teacher:	Mgr. Hana Malinská, Ph.D.
Term:	Winter + Summer
Language of instruction:	English
Lectures/exercises:	4/0 per week
Completion:	Exam
Course goal:	The course is focused on basic principles and methods in plant biotechnology. The set of lectures covers topics from plant molecular genetics to social acceptance of GMOs, focusing on plant cultivation *in vitro*.
Requirements on student:	Knowledge from Plant physiology (bachelor level). Students are expected to learn and understand basic terminology, approaches and methods used in plant biotechnology.
Abstract:	Content: 1. Plant genomes 2. Plant tissue culture 3. Techniques for plant transformation 4. Vectors for plant transformation 5. The genetic manipulation of herbicide tolerance 6. The genetic manipulation of pest resistance 7. Plant disease resistance 8. Reducing the effects of viral disease 9. Strategies for engineering stress tolerance 10. The improvement of crop yield and quality 11. Molecular farming 12. Public acceptance of genetically modified crops
Prerequisites - other information about course preconditions	General Botany, General Molecular Biology
Competences acquired	Students will learn and understand basic terminology, approaches and methods used in plant biotechnology.
Literature	Basic: Slater A., Scott N., Fowler M. Plant biotechnology: the genetic manipulation of plants. 2nd ed. Oxford: Oxford University Press, 2008. Recommended: Lindsey K. Plant tissue culture. Manual. Kluwer Academic Publishers, London, 1992. Smith R. H. Plant tissue culture. Techniques and experiments. Second edition. Academic Press, 2000. Altman A., Hasegawa, P.M. Plant Biotechnology and Agriculture: Prospects for the 21st Century. 1st ed. Academic Press, 2011.

Faculty/Institute:	Faculty of Science / Department of Biology
Course title:	**Methods in Molecular Biology**
Course code:	KBI / E116
ECTS:	7
Level of course:	Bachelor + Master
Teacher:	Mgr. Michaela Liegertová, Ph.D.
Term:	Winter + Summer
Language of instruction:	English
Lectures/exercises:	4/0 per week
Completion:	Exam
Course goal:	The course is focused on methods for genome manipulations in traditional and modern model organisms. The set of lectures covers most recent advances in molecular genetics and genetic engineering. During practical part of the course students will be trained in the basics of bioinformatics.
Requirements on student:	Students are expected to learn and understand basic terminology, approaches and methods used in modern molecular genetics and genetic engineering.
Abstract:	Content: 1. Model organisms (history, basic terminology) 2. *E. coli* (basics of cloning, recombinant DNA technology) 3. Yeasts (2-hybrid system) 4. *C. elegans* (RNAi) 5. Insects (P-element transformation, Gal4/UAS system) 6. *P. dumerilii* (gene expression profiling in cellular resolution) 7. Lancelets (RNA in situ/FISH) 8. Fish (meganuclease, Zn-finger nucleases, TALENs) 9. Amphibians (morpholino knock-down) 10. *G. domesticus* (viral transgenesis) 11. *M. musculus* (ES cells modifications, Cre-LoxP system, CRISPR/Cas9 system) 12. Basics of Bioinformatics (+ practical exercise)
Prerequisites - other information about course preconditions	General Zoology, Cell Biology
Competences acquired	Students will learn and understand basic terminology, approaches and methods used in molecular genetics and genetic engineering.

DEPARTMENT OF PHYSICS

Faculty/Institute:	Faculty of Science / Department of Physics
Course title:	**Atomic and Nuclear Physics**
Course code:	KFY / P511
ECTS:	6
Level of course:	bachelor
Teacher:	doc. RNDr. Anna Macková, Ph.D.
Term:	winter semester
Language of instruction:	english
Lectures/exercises:	3/2 per week
Completion:	credit, exam
Prerequisites:	
Course goal:	1. In the frame of the course will be explained the basic concepts of atomic and nuclear physics. We begin with description of atomic models as were developed in accordance to the important experiments accomplished at the beginning of 20th century. 2. Thomson's experiment, discovery of electron, Rutherford experiment leading to the hypothesis of atomic nuclei, the observation of optical spectral lines during study of discharges in gases will be discussed. The study of spectral lines led to the Bohr atom model and to the birth of quantum mechanics itself. The atomic orbital model provided a new theoretical basis for spectroscopy. 3. Main experiments leading to quantum theory introduction will be studied and commented in the frame of classical and quantum physics differences: photoelectric effect and its Einstein's interpretation, Compton's effect and wave-particle duality of particles, Davison-Germer experiment, Planck's interpretation of black-body radiation. 4. Basic ideas and concepts of quantum mechanics will be presented and applied in the frame of quantum-mechanic model of hydrogen atom. Schrödinger equation for hydrogen atom will be solved and then we discuss the meaning of the hydrogen atom wave functions and energies. 5. In the frame of atomic shell structure will be looked through the Frank-Hertz experiment, angular momentum of electron, spin of electron, magnetic behavior of atoms, atomic shell structure in accordance with periodic table of elements. The basic information about the origin, main principles and experimental data connected with atomic optical spectra will be presented and followed by discussion about the basic rules adopted for electromagnetic transition probability. 6. Basic X-ray emission mechanism will be described and X-ray application in material science and medicine will be briefly introduced. 7. The concept of electron spin will be shown on experiments leading to the electron spin discovery (Stern-Gerlach experiments with atomic beam in non-homogeneous magnetic field, Einstein-de Haas experiment dealing with macroscopic magnetic momentum measurement). Spin-orbital coupling of electrons causing fine structure of electronic levels in atoms will be discussed. In the second part of course we will focus on nuclear physics – firstly discovery of proton and neutron and first atomic nuclei models will be introduced. Basic physical quantitities as nuclei mass, binding energy as a function of nucleon number will be presented. 8. Natural radioactivity, radioactivity decay rules, conservation laws and types will be described - production of alpha, beta and gamma

	particles. 9. Cosmic rays origin and physical properties will be presented. Nuclear reactions, types of nuclear radiation, conservation laws and cross sections of these processes in accordance with the type of interaction (strong, weak, electromagnetic interaction) will be mentioned. 10. We will touch the following topics - nuclear models, neutrons and protons in nuclei and their characteristics, basic characteristics of other particles, different types of nuclear reactions, fission and its application in nuclear reactors, detectors of ionizing radiation, main principles of detection of neutral and charged particles.
Abstract:	
Literature:	

Faculty/Institute:	Faculty of Science / Department of Physics
Course title:	**Electricity and Magnetism**
Course code:	KFY / P311
ECTS:	7
Level of course:	bachelor
Teacher:	doc. RNDr. Jaroslav Pavlík, CSc.
Term:	winter semester
Language of instruction:	english
Lectures/exercises:	4/2 per week
Completion:	credit, exam
Prerequisites:	
Course goal:	The main aim of this lecture is to introduce students to basics of electricity and magnetism. Preface is discussed basic mathematical appliance of vector algebra and analysis. The lecture continues in study of electric charge and electric field, system of conductors, study of dielectrics, energy and power in electric field, continues with electric current and stationary electric field, magnetic field and non-stationary electromagnetic field and basics of circuits. The course finishes in Maxwell´s equations.
Abstract:	
Literature:	

Faculty/Institute:	Faculty of Science / Department of Physics
Course title:	**Oscillations and Waves. Optics.**
Course code:	KFY / P411
ECTS:	7
Level of course:	bachelor
Teacher:	RNDr. Eva Hejnová, Ph.D.
Term:	winter semester
Language of instruction:	english
Lectures/exercises:	4/2 per week
Completion:	credit, exam
Prerequisites:	
Course goal:	The third part of the elementary course of physics is aimed at oscillations and waves, concretely it deals with wave properties of light, wave optics, geometrical optics, quantum optics, light propagation in izotropic and anizotropic surroundings, sources of the radiation, photometry, optical measurements.
Abstract:	
Literature:	

Faculty/Institute:	Faculty of Science / Department of Physics
Course title:	**Thermodynamics and Statistical Physics**
Course code:	KFY / P369
ECTS:	4
Level of course:	master
Teacher:	doc. RNDr. Filip Moučka, Ph.D., doc. RNDr. Michal Varady, Ph.D.
Term:	winter semester
Language of instruction:	english
Lectures/exercises:	3/1 per week
Completion:	credit, exam
Prerequisites:	
Course goal:	Theoretical introduction into the equilibrium thermodynamics and statistical physics for students of physics and teachers of physics.
Abstract:	Basic principles of Thermodynamics. Entropy. Thermodynamic potentials. Open systems. Phase equilibrium and transitions. Low Temperatures. Ideas and principles of statistical physics: thermodynamic vs. mechanical properties, statistical description, statistical ensemble and distribution, ergodicity, quantum vs. classical mechanical description. Microcanonical ensemble: Liouville's thorem, microcanonical distribution, number of microscopic states. Canonical ensemble: Boltzmann's distribution, canonical partition function, thermodynamic properties in canonical ensembles. Quasiclassical approximation: equipartition theorem, Maxwell-Boltzmann's distribution, Barometric formula. Classical ideal gas: classical approximation, de Broglie wavelength, contributions to canonical partition function and thermodynamic properties: translational, rotational, vibrational, electronic. Heat capacity. Ideal crystal: Classical, Einstein and Debye models, partition functions and heat capacity. Quantum ideal gasses: Bose-Einstein and Fermi-Dirac statistics, blackbody radiation. Interacting systems: molecular models, interaction energy and potentials, virial equation for gasses, the second virial coefficient. Numerical methods in statistical physics: Monte Carlo, Metropolis algorithm, molecular simulation.
Literature:	Pippard, A.B.: Elements of Classical Thermodynamics, Cambridge Univ. Press, 1964 Fermi, E.: Thermodynamics, Dover Publications, Inc., New York, 1936 Mandl, F.: Statistical Physics, John Willey and Sons, 2002 Reif, F.: Fundamentals of Statistical and Thermal Physics, McGraw-Hill Series in Fundamentals of Physics, 1965

Faculty/Institute:	Faculty of Science / Department of Physics
Course title:	**Solid State Physics I**
Course code:	KFY / P861
ECTS:	4
Level of course:	bachelor
Teacher:	RNDr. Martin Švec, Ph.D.
Term:	summer semester
Language of instruction:	english
Lectures/exercises:	2/1 per week
Completion:	credit, exam
Prerequisites:	
Course goal:	Structure of solids, basic principles of experimental techniques of structure determination. Crystal lattice, oscillations of crystal lattice, specific heats. Crystalline defects, stiffness of crystals. Electrical properties of solids. Basics of the band theory of solids. Classification of matters based on electric conductivity. Electrons in periodic potential. Intrinsic and extrinsic semiconductors and their applications. Transport phenomena in solids. Magnetic properties of solids. Superconductivity.
Abstract:	
Literature:	

Faculty/Institute:	Faculty of Science / Department of Physics
Course title:	**Solid State Physics II**
Course code:	KFY / P961
ECTS:	5
Level of course:	master
Teacher:	RNDr. Martin Švec, Ph.D.
Term:	winter semester
Language of instruction:	english
Lectures/exercises:	2/1 per week
Completion:	credit, exam
Prerequisites:	KFY/P861 (Solid State Physics I)
Course goal:	Optical properties of solids, interaction of electromagnetic radiation with matter, photoconductance. Special properties of surfaces, thermoemission. Experimental methods of solid state physics. Boundaries of two solids, PN transition and it's application in electronics. Boundaries of solids and vacuum, emission of particles, photoeffects at boundaries. Interactions of ions with solids, applications. Basics of physics of thin solid films.
Abstract:	
Literature:	

Faculty/Institute:	Faculty of Science / Department of Physics
Course title:	**An Introduction to Quantum Physics**
Course code:	KFY / P530
ECTS:	3
Level of course:	Bachelor
Teacher:	doc. RNDr. Dušan Novotný, CSc.
Term:	summer semester
Language of instruction:	english
Lectures/exercises:	3/1 per week
Completion:	credit, exam
Prerequisites:	
Course goal:	The lecture is the first part of the course, which is aimed at an understanding the fundamentals of quantum mechanics (QM) and its importance in the modern physics. Theoretical and experimental starting points of QM. The mathematical introduction. The postulates of QM - a general discussion. Schrödinger equation. The measurement in QM. The uncertainty relations. The relations of QM to the classical mechanics (the classical limits). Simple problem in one dimension (the free particle, the single-step potential, the continuity equation for probability, the quantum tunnelling, the particle in a potential box). The harmonic oscillator. The angular momentum (the eigenvalue problem of L^2 and L_z).
Abstract:	
Literature:	

Faculty/Institute:	Faculty of Science / Department of Physics
Course title:	**Quantum Physics**
Course code:	KFY / P737
ECTS:	5
Level of course:	Master
Teacher:	doc. RNDr. Dušan Novotný, CSc.
Term:	summer semester
Language of instruction:	english
Lectures/exercises:	3/1 per week
Completion:	credit, exam
Prerequisites:	KFY/P530 (An Introduction to Quantum Physics)
Course goal:	This lecture is closely continuous with Quantum mechanics II. Hydrogen atom. Spin. Pauli-equation. The approximate methods of the quantum mechanics (QM). The generalization of QM to many-particle systems. Identical particles and the principle of their indistinguishability. Bosons and fermions. The one-particle approximation. The Pauli exclusion principle. The basic idea of a relativistic quantum theory (Klein-Gordon and Dirac equation).
Abstract:	
Literature:	

Faculty/Institute:	Faculty of Science / Department of Physics
Course title:	**Measurements and Processing of Experimental Data**
Course code:	KFY / PA51
ECTS:	4
Level of course:	master, bachelor
Teacher:	doc. RNDr. Jaroslav Pavlík, CSc.
Term:	summer semester
Language of instruction:	english
Lectures/exercises:	2/0 per week
Completion:	credit, exam
Prerequisites:	
Course goal:	The subject introduces basic pieces of knowledge for measurement evaluations including errors determination, measurement uncertainty and basics of regression analysis. Random quantities, important distributions of probability, the method of least squares. Directly and indirectly measured quantities. Measurement methods. Interpolation.
Abstract:	
Literature:	

Faculty/Institute:	Faculty of Science / Department of Physics
Course title:	**Numerical Mathematics I**
Course code:	KFY / P303
ECTS:	5
Level of course:	bachelor
Teacher:	prof. Ing. Martin Lísal, DSc.
Term:	winter semester
Language of instruction:	English
Lectures/exercises:	regular consultations
Completion:	credit, exam
Prerequisites:	
Course goal:	Most problems in science and technology cannot be solved in closed form, and numerical methods have to be applied to calculate approximate solutions. The course provides background and implementation details for practical applications of basic numerical methods for solution of non-linear equations, solution of set of linear equations, interpolation and extrapolation, and numerical integration and derivation.
Abstract:	A student will gain theoretical knowledge about basic numerical methods for solution of non-linear equations, solution of set of linear equations, interpolation and extrapolation, and numerical integration and derivation. The student will also exercise the theoretical knowledge on practical examples.
Literature:	

Faculty/Institute:	Faculty of Science / Department of Physics
Course title:	**Numerical Mathematics II**
Course code:	KFY / P402
ECTS:	5
Level of course:	bachelor
Teacher:	prof. Ing. Martin Lísal, DSc.
Term:	summer semester
Language of instruction:	english
Lectures/exercises:	regular consulations
Completion:	credit, exam
Prerequisites:	KFY/P303 (Numerical Mathematics I)
Course goal:	Most problems in science and technology cannot be solved in closed form, and numerical methods have to be applied to calculate approximate solutions. The course provides background and implementation details for practical applications of numerical methods for solution of ordinary differential equations and solution of partial differential equations by finite difference methods.
Abstract:	A student will gain theoretical knowledge about numerical methods for solution of ordinary differential equations and solution of partial differential equations by finite difference methods. The student will also exercise the theoretical knowledge on practical examples.
Literature:	

Faculty/Institute:	Faculty of Science / Department of Physics
Course title:	**Numerical Methods of Hydrodynamics**
Course code:	KFY / P753
ECTS:	6
Level of course:	master
Teacher:	RNDr. Michal Varady, Ph.D.
Term:	Winter semester
Language of instruction:	English
Lectures/exercises:	2/2 per week
Completion:	credit, exam
Prerequisites:	
Course goal:	An introductory course on numerical methods based on finite differences algorithms applicable to the solution of partial differential equations in hydrodynamics. The course is eligible to students of computer modelling.
Abstract:	
Literature:	

Faculty/Institute:	Faculty of Science / Department of Physics
Course title:	**MPI Parallel Programming**
Course code:	KFY / P852
ECTS:	6
Level of course:	master
Teacher:	prof. Ing. Martin Lísal, DSc.
Term:	summer semester
Language of instruction:	english
Lectures/exercises:	regular consultations
Completion:	credit, exam
Prerequisites:	
Course goal:	The course provides introduction to Message Passing Interface (MPI) library that has become a standard parallelization tool for computers with distributed memory architecture. MPI is first explained on simple examples written in FORTRAN90. It is followed by a summary of frequently used MPI subroutines. Afterwards, the use of MPI is demonstrated on three examples: parallel tempering technique, hybrid Monte Carlo and molecular dynamics simulations for Lennard-Jones fluids.
Abstract:	A student will gain an overview about Message Passing Interface (MPI) - a standard parallelization tool for computers with distributed memory architecture. The student will exercise MPI programming on practical examples.
Literature:	

Faculty/Institute:	Faculty of Science / Department of Physics
Course title:	**Computational Physics III**
Course code:	KFY / P953
ECTS:	5
Level of course:	master
Teacher:	RNDr. Martin Švec, Ph.D.
Term:	winter semester
Language of instruction:	english
Lectures/exercises:	1/2 per week
Completion:	credit, exam
Prerequisites:	
Course goal:	Basic algorithms of particle and fluid modelling in solid-state physics, microelectronics and optoelectronics. Modelling of thin film growth - 2D growth, 3D growth, application of image processing methods. Study of morphological properties of composite films. Study of transport properties of thin metal films and composite films. Introduction to Fourier optics and percolation theory.
Abstract:	
Literature:	

Faculty/Institute:	Faculty of Science / Department of Physics
Course title:	**Computer Modelling – Particle Modelling**
Course code:	KFY / P523
ECTS:	4
Level of course:	bachelor
Teacher:	RNDr. Marek Malý, Ph.D., prof. Ing. Martin Lísal, DSc.
Term:	winter semester
Language of instruction:	english
Lectures/exercises:	regular consultations
Completion:	credit, exam
Prerequisites:	
Course goal:	Hardware and software fundamentals of computational physics. Main directions of classical computational physics. Mathematical and computer modelling. Molecular modelling: simulation domains, particle interactions, Monte Carlo methods, molecular dynamics, dissipative particle dynamics, practical examples. Fluid modelling and hybrid modelling.
Abstract:	
Literature:	

Faculty/Institute:	Faculty of Science / Department of Physics
Course title:	**Seminar of Computer Modelling I**
Course code:	KFY / P501
ECTS:	3
Level of course:	bachelor
Teacher:	RNDr. Marek Malý, Ph.D.
Term:	winter semester
Language of instruction:	english
Lectures/exercises:	0/2 per week
Completion:	credit
Prerequisites:	
Course goal:	The purpose of this course is to practice the algorithms used in computer physics such as Molecular Dynamics, Monte Carlo, Simulated Annealing etc. Illustrative problems: Travelling Salesman Problem, Simulation and analysis of the hard spheres system, 1D hybrid modelling of plasma-probe interaction etc.
Abstract:	
Literature:	

Faculty/Institute:	Faculty of Science / Department of Physics
Course title:	**Programming C/C++**
Course code:	KFY / P235
ECTS:	3
Level of course:	bachelor
Teacher:	RNDr. Marek Malý, Ph.D.
Term:	winter semester
Language of instruction:	english
Lectures/exercises:	0/3 per week
Completion:	credit
Prerequisites:	
Course goal:	In the course basics of programming in C/C++ language are presented and practised on PC lab. Students learn to think algorithmically and write console and simple GUI applications.
Abstract:	
Literature:	

Faculty/Institute:	Faculty of Science / Department of Physics
Course title:	**Programming A**
Course code:	KFY / P103
ECTS:	3
Level of course:	bachelor
Teacher:	RNDr. Zdeněk Moravec, Ph.D.
Term:	winter semester
Language of instruction:	english
Lectures/exercises:	0/3 per week
Completion:	credit
Prerequisites:	
Course goal:	Course of programming in the Fortran language (Fortran norms 90 and 95). Using compilers for Linux (Intel Fortran) and using dislin graphics routines.
Abstract:	
Literature:	

Faculty/Institute:	Faculty of Science / Department of Physics
Course title:	**Physical Problems and Their Solutions A - for elementary school teachers**
Course code:	KFY / P736
ECTS:	3
Level of course:	master
Teacher:	RNDr. Eva Hejnová, Ph.D., RNDr. Jiří Králík, Ph.D.
Term:	winter semester
Language of instruction:	english
Lectures/exercises:	0/2 per week
Completion:	credit
Prerequisites:	
Course goal:	Seminar is aimed at the solving of physical problems from educational physics. The emphasis is given to solving questions concerning misconceptual ideas from mechanics and thermal physics, and some more difficult school problems.
Abstract:	
Literature:	

Faculty/Institute:	Faculty of Science / Department of Physics
Course title:	**Physical Problems and Their Solutions B - for elementary school teachers**
Course code:	KFY / PA26
ECTS:	3
Level of course:	master
Teacher:	RNDr. Eva Hejnová, Ph.D., RNDr. Jiří Králík, Ph.D.
Term:	summer semester
Language of instruction:	english
Lectures/exercises:	0/2 per week
Completion:	credit
Prerequisites:	
Course goal:	Seminar is aimed at the solving of physical problems from educational physics. The emphasis is given to solving questions concerning misconceptual ideas from electricity, magnetism, optics, physics of atoms, and some more difficult school problems.
Abstract:	
Literature:	

Faculty/Institute:	Faculty of Science / Department of Physics
Course title:	**Physics of Cosmic Plasma and magnetohydrodynamics**
Course code:	KFY / P865
ECTS:	5
Level of course:	master
Teacher	Doc. RNDr. Michal Varady, Ph.D.
Term:	summer semester
Language of instruction:	english
Lectures/exercises:	2/1 per week
Completion:	credit, exam
Prerequisites:	
Course goal:	The course presents an introduction to plasma physics with a stress to applications in the space physics and astrophysics. The first part of the course is devoted to the standard plasma theory (plasma properties, motion of individual charged particles in electromagnetic fields, magnetic mirroring, waves in plasma, transport theory, instabilities, fundamentals of kinetic theory) the second part of the course is devoted to the magnetohydrodynamic description of large scale plasma phenomena.
Abstract:	
Literature:	

Faculty/Institute:	Faculty of Science / Department of Physics
Course title:	**Modelling of Processes in Technology I**
Course code:	KFY / P864
ECTS:	4
Level of course:	bachelor, master
Teacher:	RNDr. Marek Malý, Ph.D.
Term:	summer semester
Language of instruction:	english
Lectures/exercises:	2/1 per week
Completion:	credit, exam
Prerequisites:	
Course goal:	The goal of this course is to give an introduction to the software package Simulink for modelling and analysing dynamic systems. Students are acquainted with the basic tools needed to use the Simulink package. Besides of usage of predefined built-in functional blocks also creation of own functional blocks is demonstrated on examples. The possibility to combine Matlab and Simulink for problem solving is demonstrated as well.
Abstract:	

Faculty/Institute:	Faculty of Science / Department of Physics
Course title:	**Modelling of Processes in Technology II**
Course code:	KFY / P963
ECTS:	5
Level of course:	master
Teacher:	RNDr. Marek Malý, Ph.D.
Term:	winter semester
Language of instruction:	english
Lectures/exercises:	2/2 per week
Completion:	credit, exam
Course goal:	Introduction to artificial neural networks, genetic algorithms and some other heuristic optimisation algorithms.
Abstract:	
Literature:	

Faculty/Institute:	Faculty of Science / Department of Physics
Course title:	**Programming – Matlab**
Course code:	KFY / P130
ECTS:	3
Level of course:	bachelor
Teacher:	RNDr. Martin Švec, Ph.D.
Term:	winter semester
Language of instruction:	english
Lectures/exercises:	0/3 per week
Completion:	credit
Prerequisites:	
Course goal:	In the course basics of programming in Matlab language are presented and practised. Students learn to think algorithmically and write simple applications.
Abstract:	
Literature:	

Faculty/Institute:	Faculty of Science / Department of Physics
Course title:	**Ion Analytic Methods**
Course code:	KFY / P293
ECTS:	2
Level of course:	master
Teacher:	doc. RNDr. Anna Macková, Ph.D.
Term:	winter/summer semester
Language of instruction:	english
Lectures/exercises:	18 hours in 3x 6 hour block including practice in laboratory
Completion:	credit
Prerequisites:	
Course goal:	The lecture is focused on the physical description of the main processes taking place in the interaction of charged and neutral particles with the solid, where there are a series of elastic and inelastic processes involving the incident particles and the atoms of the target material.
Abstract:	In addition, a neutron nuclear analytical method for elemental analysis, it means neutron activation analysis (NAA) and neutron depth profiling (NDP), will be part of lectures based on nuclear reactions with light nuclei of the studied material. Part of the lecture is a basic description of these phenomena, their physical principles and the use of these processes for qualitative and quantitative elemental analysis of materials. In the frame of the lecture main physical principles and applications of ion analytical methods will be described, which are used for the study of surface properties and solids interface. Ion beam analytical techniques and neutron beam techniques will be directly discussed in connection to significant applications in material science and technology. Ion elastic processes with target nuclei (RBS - Rutherford back scattering, ERDA - RBS-channeling) will be presented as well as inelastic processes with electrons of target atoms or nuclear reactions (PIXE - proton-induced retgenic fluorescence, NRA - analysis by nuclear reactions). At the end of the lecture is presented an overview of methods, their use and comparison of analytical possibilities they provide (sensitivity, depth and area resolution, lowest detectable concentration etc.) 1. Elastic and inelastic processes occurring after impact of charged particles on solids 2. Sources of charged particles for nuclear analysis 3. Basic principles of ion spectroscopy, X-ray. and gamma spectroscopy 4. Fundamentals of ion beam analytical methods - RBS, ERDA, quantitative and qualitative analysis 5. Fundamentals of Nuclear Analytical Ion Methods - PIXE PIGE, NRA, Quantitative and Qualitative Analysis 6. Method of ion channeling in crystalline materials 7. Ion microprobe and elemental lateral mapping 8. Application of ion beam analytical methods on different types of materials - sensitivity, element profiling, detection limits 9. Elastic and inelastic processes occurring after the neutrons impact on the solid 10. Neutron sources - nuclear reactors and instrumentation of neutron diffraction and NAA 11. Basic principles of neutron spectroscopy 12. NDP, NAA - nuclear methods and their qualitative and quantitative possibilities 13. Practical exercises at the Tandetron Laboratory, ÚJF AV ČR, v. I. Practical demonstration of knowledge by performing measurements and

	elaboration of a protocol / presentation on selected topics from the lecture circle.
Literature:	1. Tirira J., Serruys Y., Trocellier P.: Forward recoil spectrometry, Plenum Press, New York 1996. Feldman L.C., Mayer J.W.: Fundamentals of surface and thin film analysis, North-Holland, New York 1986. 2. Tesmer J. R., Nastasi M.: Handbook of modern ion beam materials analysis, Materials research society, Pittsburgh 1995. 3. Frank L., Král J.: Metody analýzy povrchů; iontové, sondové a speciální metody, Academia, Praha 2002. 4. A. Mackova, A. Pratt, Handbook of Spectroscopy: Second, Enlarged Edition,2-4 (2014)741-778, Ion/Neutral Probe Techniques (Book Chapter). 5. C. Jeynes, M.J. Bailey, N.J. Bright, M.E. Christopher, G.W. Grime, B.N. Jones, V.V. Palitsin, R.P. Webb, ‘‘Total IBA’’ – Where are we?, Nuclear Instruments and Methods in Physics Research B 271 (2012) 107–118. 6. A. Zucchiatti, A. Redondo-Cubero, Ion beam analysis: New trends and challenges, Nuclear Instruments and Methods in Physics Research B 331 (2014) 48–54. 7. C. Jeynes, N. P. Barradas, and E. Szilágyi, Accurate Determination of Quantity of Material in Thin Films by Rutherford Backscattering Spectrometry, Anal. Chem., 2012, 84 (14), pp 6061–6069. 8. Kim Man Yu, Ion Beam Analysis in Materials Science, Lawrence Berkeley National Laboratory. 9. https://drive.google.com/file/d/0B2JUoXR-XKz6OWNhZWRjNGYtNTFmNC00YzFiLTkzYjItNjMzOGI2MTlhNmVk/view

Faculty/Institute:	Faculty of Science / Department of Physics
Course title:	**Physical methods of thin film deposition**
Course code:	KFY / P223
ECTS:	4
Level of course:	master
Teacher:	Mgr. Jindřich Matoušek, Ph.D.
Term:	summer semester
Language of instruction:	english
Lectures/exercises:	2/0 per week
Completion:	credit, exam
Prerequisites:	
Course goal:	The aim of this course is to achieve elementary orientation in the field of thin film deposition technology. The students should understand the relation between the composition and properties of the thin films as well as the influence of the deposition parameters. The blocks covered by this subject are: Plasma discharges (glow discharge and arc) – basic propereties, interactions of plasma discharge with electrodes and surfaces. Vacuum evaporation – principle, homogeneity of deposition. Sputtering – principle, DC, pulsed DC and RF sputtering, magnetrons, reactive sputtering. Other methods of thin film deposition – laser ablation, IBAD, Langmuir-Blodgett films, anodic oxidation. Chemical and physicochemical deposition methods – CVD, PE CVD Characterization of the deposition processes – deposition rate measurement, OES, QMS Substrate cleaning and preparation – chemical treatment, annealing, ion etching
Abstract:	
Literature:	

DEPARTMENT OF GEOGRAPHY

Faculty/Institute:	Faculty of Science / Department of Geography
Course title:	**English for Science**
Course code:	KGEO / B403
ECTS:	2
Level of course:	bachelor
Teacher:	Mgr. Ladislav Bobr
Term:	Summer semester
Language of instruction:	English
Lectures/exercises:	0/2 per week
Completion:	exam
Course goal:	The course is intended to improve the specialized geographical word power and communication skills of students as well as to show the possibilities of finding and interpreting different geographical information, and finally to show how to present the results of own research or another work.
Abstract:	1. Introductory lesson; 2. Scientific journals and other sources; 3. Writing an abstract I; 4. Writing an abstract II - practical skills; 5. Designing a research topic; 6. Reading scientific papers I - analyzing the structure; 7. Reading scientific papers II - heart of the matter; 8. Discussing the geographical problem I - environmental issues; 9. Discussing the geographical problem II - social issues; 10. Discussing the geographical problem III - regional issues; 1 1.-13. Presentation of geographical issue; 14. Closing lesson

Faculty/Institute:	Faculty of Science / Department of Geography
Course title:	**Regional geography of Northwestern Bohemia**
Course code:	KGEO / E100
ECTS:	10
Level of course:	Bachelor, Master
Teacher:	Assoc. Prof. Mgr. Pavel Raška, Ph.D. et al.
Term:	Summer + Winter
Language of instruction:	English
Lectures/exercises:	5 day per semester
Completion:	exam
Course goal:	The course focuses on selected geographical aspects of NW Bohemia, mainly as follows: (a) location and geodiversity – evolution of natural environment, landscape types, (b) development of settlement, history and recent demographical trends, (c) economic significance of the region, (d) cross-border relations with Germany (Saxonia), (e) environmental problems and (f) regional development issues. Students are attending consultations, where they get tasks and discussion questions for the above mentioned issues, and concurrently they work on a project covering these issues.
Abstract:	1. Location and geodiversity 2. Development of settlement 3. History and recent demographical trends 4. Economic significance of the region 5. Cross-border relations with Germany (Saxony) 6. Environmental problems 7. Regional development issues **The course is completed with individual reports (5 pages) based on reading of assigned literature and field observations.*

Faculty/Institute:	Faculty of Science / Department of Geography
Course title:	**Regional geography of the Czech Republic**
Course code:	KGEO / E101
ECTS:	10
Level of course:	Bachelor, Master
Teacher:	Assoc. Prof. Mgr. Pavel Raška, Ph.D. et al.
Term:	Summer + Winter
Language of instruction:	English
Lectures/exercises:	5 day per semester
Completion:	exam
Course goal:	The course focuses on selected geographical aspects of the Czech Republic, mainly as follows: (a) position in Europe, (b) geodiversity – evolution of natural environment, landscape types, (c) development of settlement, history and recent demographical trends, (d) economic significance, (e) cross-border relations, (f) environmental problems and (g) regional development issues. Students are attending consultations, where they get tasks and discussion questions for the above mentioned issues, and concurrently they work on a project covering these issues.
Abstract:	1. Location and geodiversity 2. Development of settlement 3. History and recent demographical trends 4. Economic significance of the region 5. Cross-border relations with Germany (Saxony) 6. Environmental problems 7. Regional development issues **The course is completed with individual reports (5 pages) based on reading and comparison of selected issues (e.g. environmental and developmental perspectives) with country/region of origin of the foreign student.*

Faculty/Institute:	Faculty of Science / Department of Geography
Course title:	**One-day Geographical Excursion A / Geographische Exkursion A**
Course code:	KGEO / 0023
ECTS:	1
Level of course:	Bachelor, master
Teacher:	RNDr. Ivan Farský, CSc., Mgr. Jiří Riezner, Ph.D.
Term:	Winter + Summer
Language of instruction:	Deutsch
Lectures/exercises:	1 day per semester
Completion:	exam / Prüfung
Course goal:	Eins-, Zweitägige Exkursion und Feldpraxis dient zur praktischen Übung. Die Studenten einzelne Aufgaben zu bearbeiten haben (schriftlich oder praktisch). Die auch Terrainbeobachtungen machen. Die Anforderung: Ein Exkursionsplan an der Lehrstuhlseite zu beobachten (Semester Anfang), sich in STAG zu verschreiben. Bearbeiteten Itinerar spätestens 1 Monat nach der Exkursion zur Kontrolle geweben. Gehalt: die Funktionszonen festzustellen, die Naturelemente zu beobachten. Literatur: Regional Fachliteratur (Atlanten, Karten, Jahrbüchr usw.)
Abstract:	- funktional Zonen - Natur und Umwelt - regional Geographie

Faculty/Institute:	Faculty of Science / Department of Geography
Course title:	**One-day Geographical Excursion B / Geographische Exkursion B**
Course code:	KGEO / 0024
ECTS:	1
Level of course:	Bachelor, master
Teacher:	RNDr. Ivan Farský, CSc., Mgr. Jiří Riezner, Ph.D.
Term:	Winter + Summer
Language of instruction:	Deutsch
Lectures/exercises:	1 day per semester
Completion:	exam / Prüfung
Course goal:	Eins-, Zweitägige Exkursion und Feldpraxis dient zur praktischen Übung. Die Studenten einzelne Aufgaben zu bearbeiten haben (schriftlich oder praktisch). Die auch Terrainbeobachtungen machen. Die Anforderung: Ein Exkursionsplan an der Lehrstuhlseite zu beobachten (Semester Anfang), sich in STAG zu verschreiben. Bearbeiteten Itinerar spätestens 1 Monat nach der Exkursion zur Kontrolle geweben. Gehalt: die Funktionszonen festzustellen, die Naturelemente zu beobachten. Literatur: Regional Fachliteratur (Atlanten, Karten, Jahrbüchr usw.)
Abstract:	-funktional Zonen - Natur und Umwelt - regional Geographie

Faculty/Institute:	Faculty of Science / Department of Geography
Course title:	**One-day Geographic Excursion C / Geographische Exkursion C**
Course code:	KGEO / 0064
ECTS:	1
Level of course:	Bachelor, master
Teacher:	RNDr. Ivan Farský, CSc., Mgr. Jiří Riezner, Ph.D.
Term:	Winter semester
Language of instruction:	Deutsch
Lectures/exercises:	1 day per semester
Completion:	exam / Prüfung
Course goal:	Eins-, Zweitägige Exkursion und Feldpraxis dient zur praktischen Übung. Die Studenten einzelne Aufgaben zu bearbeiten haben (schriftlich oder praktisch). Die auch Terrainbeobachtungen machen. Die Anforderung: Ein Exkursionsplan an der Lehrstuhlseite zu beobachten (Semester Anfang), sich in STAG zu verschreiben. Bearbeiteten Itinerar spätestens 1 Monat nach der Exkursion zur Kontrolle gweben. Gehalt: die Funktionszonen festzustellen, die Naturelemente zu beobachten. Literatur: Regional Fachliteratur (Atlanten, Karten, Jahrbüchr usw.)
Abstract:	- funktional Zonen - Natur und Umwelt - regional Geographie

Faculty/Institute:	Faculty of Science / Department of Geography
Course title:	**One-day Geographical Excursion D / Geographische Exkursion D**
Course code:	KGEO / 0065
ECTS:	1
Level of course:	Bachelor, master
Teacher:	RNDr. Ivan Farský, CSc., Mgr. Jiří Riezner, Ph.D.
Term:	Winter + Summer
Language of instruction:	Deutsch
Lectures/exercises:	1 day per semester
Completion:	exam / Prüfung
Course goal:	Eins-, Zweitägige Exkursion und Feldpraxis dient zur praktischen Übung. Die Studenten einzelne Aufgaben zu bearbeiten haben (schriftlich oder praktisch). Die auch Terrainbeobachtungen machen. Die Anforderung: Ein Exkursionsplan an der Lehrstuhlseite zu beobachten (Semester Anfang), sich in STAG zu verschreiben. Bearbeiteten Itinerar spätestens 1 Monat nach der Exkursion zur Kontrolle geweben. Gehalt: die Funktionszonen festzustellen, die Naturelemente zu beobachten. Literatur: Regional Fachliteratur (Atlanten, Karten, Jahrbüchr usw.)
Abstract:	1. das Marketing Struktur - der Reiseverkehr 2. Besuch der Messe

Faculty/Institute:	Faculty of Science / Department of Geography
Course title:	**Problems of Development of Czech Regions**
Course code:	KGEO / B304
ECTS:	3
Level of course:	bachelor
Teacher:	RNDr. Silvie R. Kučerová, Ph.D.
Term:	Winter semester
Language of instruction:	English
Lectures/exercises:	2/1 per week
Completion:	exam
Course goal:	Regional development issues The aim of the course is to present and discuss selected issues of regional and local development, regional policy and territorial management. The themes are presented on the example of Czechia and European countries. The emphasis will be put on the comparison with the situation in students´ homeland.
Abstract:	1. Introduction 2. Regional disparities in the Czech Republic 3. Public administration 4. Heritage, values conservation 5. Regional policy 6. EU funds 7. Tools of regional policy 8. Regional development in borderland 9. Strategy of local and regional development 10. Selected problems of RD in Usti nad Labem region I-IV

Faculty/Institute:	Faculty of Science / Department of Geography
Course title:	**Field Practice in Human Geography**
Course code:	KGEO / M312
ECTS:	3
Level of course:	bachelor
Teacher:	Mgr. Ladislav Bobr
Term:	Winter semester
Language of instruction:	English
Lectures/exercises:	0/2
Completion:	exam
Course goal:	The main aim of this course is to examine theoretical and practical knowledge of general and regional social geography by resolution of specific research tasks in the model locations. In this course students will acquire and practice geographic research methods.
Abstract:	Introduction the methods of human geographic research Practical application of research methods: - in the geography of population and settlements - in the geography of agriculture - in the geography of industry - in the geography of trade and services - in the geography of tourism

Faculty/Institute:	Faculty of Science / Department of Geography
Course title:	**Physische Geographie der Tschechischen Republik** Selected Chapters from Physical Geography of Czechia
Course code:	KGEO / M202
ECTS:	5
Level of course:	master
Teacher:	Mgr. Jiří Riezner, Ph.D.
Term:	Sommersemester
Language of instruction:	Deutsch
Lectures/exercises:	2/0 für die Woche
Completion:	exam / Prüfung
Course goal:	Physische Geographie der Tschechischen Republik - Im Rahmen der Veranstaltung wird ein Überblick über: die physisch-geographischen Rahmenbedingungen Tschechiens und ausgewählten Natur- und Kulturlandschaften besonderer Bedeutung gegeben.
Abstract:	1. Geologische Entwicklung und Verhältnisse; 2. Geomorphologische; Entwicklung und Gliederung; 3. Klima; 4. Gewässer; 5. Böden; 6. Vegetation und Tierwelt; 7. Böhmische Mittelgebirge, Erzgebirge; 8. Riesengebirge, Böhmische Schweiz; 9. Böhmisches Paradies, Křivoklátsko; 10. Třeboňsko, Böhmerwald; 11. Böhmischer Karst, Broumovsko; 12. Thayathal, Pálava, Mährischer Karst; 13. die Mährisch-Schlesische Beskyden, die Weißen Karpaten; 14. Altvatergebirge, Litovelské Pomoraví)

Faculty/Institute:	Faculty of Science / Department of Geography
Course title:	**Geographical Information Systems I**
Course code:	KGEO / B202
ECTS:	2
Level of course:	bachelor
Teacher:	Mgr. Martin Dolejš
Term:	Summer semester
Language of instruction:	English
Lectures/exercises:	0/2 per week
Completion:	exam
Course goal:	The introductory course of Geographical Information Systems aims at explaining basic terminology, introducting software tools and detailed description of the ESRI products and their functions.
Abstract:	1. Software tools for GIS. 2. Basic philosophy of ArcGIS. 3. Working environment in ArcGIS 10.x. 4. Map field. 5. Geodatabase, attributes, data selection. 6. Metadata, ArcCatalogue. 7. Geospatial analysis. 8. Map construction. 9. Working environment in ArcMap. 10.–12. Individual work. 13. Presentation of semestral projects.

Faculty/Institute:	Faculty of Science / Department of Geography
Course title:	**Geographical Information Systems II**
Course code:	KGEO / B300
ECTS:	4
Level of course:	bachelor
Teacher:	Mgr. Martin Dolejš,
Term:	Winter semester
Language of instruction:	English
Lectures/exercises:	0/2 per week
Completion:	exam
Course goal:	The course aims at advanced methods of data processing in GIS, mainly on the applications of 3d Analyst, Spatial Analyst, Network Analyst and other modules.
Abstract:	1. Using GIS in geographical projects, specific tools of GIS. 2. Principles of extensions in ArcGIS. 3. Map Algebra. 4. Spatial Analysis. 5. Creating a analysing DEM. 6. Optimal route, corridor, viewshed. 7. Hydrological analysis. 8. Geostatistics I. 9. Geostatistics II. 10. Maplex. 11. Mapbook/Publisher. 12. Model Builder.

Faculty/Institute:	Faculty of Science / Department of Geography
Course title:	**Urban Environmentalistics**
Course code:	KGEO / M300
ECTS:	5
Level of course:	master
Teacher:	Assoc. Prof. Mgr. Pavel Raška, Ph.D.
Term:	Winter semester
Language of instruction:	English
Lectures/exercises:	2/1 per week
Completion:	exam
Course goal:	The course introduces students to fundamental problems of urban environment contextualized in the development of cities through the history. The first part is devoted to conceptualization of the “urban” and rationalization of the study of urban environment to address global challenges. The second part gives an overview of specificities of urban environment (soils, climate, hydrologic cycle etc.) in contrast to (semi-)natural areas. Final part provides an introduction to planning theories and paradigms of the 20th century, with emphasis goven to environmental issues.
Abstract:	1. Defining urban, rural and rurban 2. Urban environment and global challenges I 3. Urban environment and global challenges II 4. Origin and development of cities 5. Historical and “new” cities 6. Urban geology and soils 7. Urban climate 8. Urban hydrological cycle 9. Urban greenery and parks 10. Natural hazards and risks 11. Urbanism and architecture in the 20th Century

Faculty/Institute:	Faculty of Science / Department of Geography
Course title:	**Methods and Application of Historical Geography**
Course code:	KGEO / M310
ECTS:	3
Level of course:	master
Teacher:	Assoc. Prof. Mgr. Pavel Raška, Ph.D.
Term:	Winter semester
Language of instruction:	English
Lectures/exercises:	0/2 per week
Completion:	exam
Course goal:	The course is designed as a cycle of discussion of scholarly papers devoted to data, methods and themes in historical geography/environment history. Students are expected carry an individual minor research based on primary data.
Abstract:	1. Historical geography and environmental history 2. The history and the future in landscape science 3. Documentary proxies in historical geography 4. Historical event inventories and time series 5. Old maps 6. Narrative sources and narrative analyses 7. Visual sociology 8. Complexities in land use change studies 9. Presentation of students´ projects I 10. Presentation of students´ projects II 11. Presentation of students´ projects III

Faculty/Institute:	Faculty of Science / Department of Geography
Course title:	**Natural Hazards and Risks**
Course code:	KGEO / M212
ECTS:	3
Level of course:	master
Teacher:	Assoc. Prof. Mgr. Pavel Raška, Ph.D.
Term:	Summer semester
Language of instruction:	English
Lectures/exercises:	0/2 per week
Completion:	exam
Course goal:	The course is intended to introduce students to the fundamental concepts related to natural hazards and risks, basic types of natural hazards including examples from Czechia and abroad. After then, the attention is devoted to model of risks and to the approaches to their assessment from the perspective of geosciences, social sciences and complex modelling at a local/regional scale.
Abstract:	1. Introduction - the role of natural hazards in nature-society relations 2. Fundamental concepts - hazards, disaster, risk, vulnerability, exposure 3. Models of natural risks 4. Types of natural risks according to underlying hazard I 5. Types of natural risks according to underlying hazard II 6. Natural hazards in the World 7. Natural hazards in Czechia (Central Europe) 8. Geoscientific approaches to risk assessment I 9. Geoscientific approaches to risk assessment II 10. Social inquiry and risk assessment I 11. Social inquiry and risk assessment I 12. Risk modelling at a local/regional scale *13. *the lesson is reserved for field work*

Faculty/Institute:	Faculty of Science / Department of Geography
Course title:	**GIS Project**
Course code:	KGEO / M211
ECTS:	3
Level of course:	master
Teacher:	Mgr. Martin Dolejš
Term:	Summer semester
Language of instruction:	English
Lectures/exercises:	0/2 per week
Completion:	exam
Course goal:	The course aims to develop students' skills through team GIS project, including research design and hypothesis, data collection, design of the suitable methodological approach, data processing and presentation (visualisation).
Abstract:	Theory: Introduction, problems of large GIS projects in practice, concepts, redaction and work in teams. Practice: Processing of the assigned part of the team GIS project and research report summary and presentation.

DEPARTMENT OF INFORMATICS

Faculty/Institute:	Faculty of Science / Department of Informatics
Course title:	**Operating Systems Administration**
Course code:	KI / AOS
ECTS:	2
Level of course:	bachelor
Teacher:	Ing. Pavel Kuba, Ph.D.,
Term:	Summer semester
Language of instruction:	English
Lectures/exercises:	2/0 per week
Completion:	Pre-Exam Credit
Course goal:	Laboratory exercises are focused on gaining practical experience with administration of operating systems. The aim of this practically based course is to introduce students to the principles of the most widely used enterprise systems with emphasis on their reliability and security. The focus will be to understand and manage Microsoft Windows Server environment and Active Directory group policies.
Abstract:	1. Directory Services - an overview, history, function, safety aspects, LDAP 2. Active Directory - domains, organizational units, sites 3. Trees and forest, global catalog, DNS integration 4. Working with AD objects, ADSI, methods of administration 5. Methods of OS deployment, directory services and applications 6. The roles and functions of the server, terminal services, Internet Information Server 7. Network Services, DNS, DHCP, DirectAccess 8. Security and distribution groups, profiles, trusts, NTDSUTIL 9. Group Policy 10. Redundant Array of Independent Disks 11. PowerShell scripting environment 12. Methods of unattended installation

Faculty/Institute:	Faculty of Science / Department of Informatics
Course title:	**Algorithms and Data Structures**
Course code:	KI / DSA
ECTS:	5
Level of course:	bachelor
Teacher:	Mgr. Květuše Sýkorová, RNDr. Jiří Škvor, Ph.D.
Term:	Summer semester/Winter semester
Language of instruction:	English
Lectures/exercises:	2/2 per week
Completion:	Exam
Course goal:	The course is targeted to the basic data structures, especially is focussed on the list, queue, stack, linked list, hash table, index, searching tree structures and on the algorithms over this structures. Attention is paid not only to the formal description of above mentioned structures and algorithms, but also to its practical implementation.
Abstract:	1. Terminology, time complexity, memory complexity 2. Basic data structures - array, list, stack, queue 3. Sorting algorithms O(n^2) - SelectSort, InsertSort, BubbleSort 4. Sorting algorithms O(n^k) - ShellSort, KnuthSort, HeapSort 5. Sorting algorithms O(n.log_k n) - QuickSort, MergeSort 6. Sorting algorithms O(k.n) - RadixSort, BucketSort 7. Searching algorithms - Brute Force, Binary Search, Interpolation Search 8. Indexing - Dense Index, Sparse Index, Multilevel Index 9. Hashing - Close Hash Table, Open Hash Table, Perfect Hash, Rehash 10. Tree structures - properties, Binary Tree, Binary Search Tree 11. Tree structures - Digi Tree, B-Tree 12. Balanced tree structures - AVL-tree, Red-Black tree 13. Special tree structures - Trie, Splay, Treap, Randomized BST

Faculty/Institute:	Faculty of Science / Department of Informatics
Course title:	**Data Analysis and Visualisation**
Course code:	KI / AVD
ECTS:	4
Level of course:	bachelor
Teacher:	doc. RNDr. Sergii Babichev, CSc., RNDr. Zbyšek Posel, Ph.D., RNDr. Jiří Škvor, Ph.D.,
Term:	Summer semester/ Winter semester
Language of instruction:	English
Lectures/exercises:	2/2 per week
Completion:	Pre-Exam Credit
Course goal:	The course focuses on the presentation of information that are necessary to the basic and comprehensive evaluation of the data. Emphasis is placed on gaining the ability to visualize data by appropriate means. An integral part of the course is the practical application of theoretical knowledge on available data using appropriate software tools (typically R, Matlab, Excel).
Abstract:	1. Introduction to measurement theory: estimation of measurement error, error propagation and uncertainties 2. Basic concepts of descriptive statistics: methods of data processing, frequency distribution (histogram, polygon) 3. The statistical analysis of univariate data: moment/ quantile measures of central tendency, variability, skewness and kurtosis 4. Statistical analysis of multivariate data: correlation, factor and cluster analysis 5. Regression analysis: linear and nonlinear regression models 6. Analysis of time series: graphical analysis, decomposition, autocorrelation, trend modeling 7. Index analysis: simple and composite individual indices, aggregate indexes 8. Signal and image processing: filtering, transformation (Fourier, wavelets) 9. Summary of selected techniques of static and dynamic visualization

Faculty/Institute:	Faculty of Science / Department of Informatics
Course title:	**IT Architecture and Infrastructure**
Course code:	KI / AIT
ECTS:	3
Level of course:	bachelor
Teacher:	RNDr. Jan Krejčí, Ph.D.
Term:	Winter semester
Language of instruction:	English
Lectures/exercises:	2/0 per week
Completion:	Exam
Course goal:	This course is focused on methods and standards used in planning of architecture and infrastructure of informational systems/technology (IT). During the theoretical training students will learn about the different norms and standards. In practical seminar works students will go through the entire process of IT projects. Except planning architecture will students learn about infrastructure elements and their technologies.
Abstract:	1. Life cycle of Information technology (IT) 2. Dependability of IT infrastructures 3. Global architecture 4. Data, functional and processing architecture 5. Architecture of applications 6. Technological architecture 7. Infrastructure of computer networks 8. Networks of storages 9. Virtual IT infrastructure 10. IaaS 11. Digitalization and virtualization of projects 12. Design and optimization of development IT architecture/infrastructure 13. Complex management of IT projects

Faculty/Institute:	Faculty of Science / Department of Informatics
Course title:	**Computer Architecture**
Course code:	KI / APC
ECTS:	3
Level of course:	bachelor
Teacher:	Ing. Pavel Kuba, Ph.D., doc. RNDr. Viktor Maškov, DrSc.,
Term:	Winter semester
Language of instruction:	English
Lectures/exercises:	2/0 per week
Completion:	Exam
Course goal:	This course is focused on computer hardware, and principles of IBM architecture. Individual subsystems of PC are discussed with a focus on modern trends.
Abstract:	1. Computer history 2. Architecture of digital computers-design, usage, building blocks of contemporary computers 3. Motherboard architecture and buses-components, architecture, chipsets, control unit (Northbridge, Southbridge), BIOS (Setup), UEFI. 4. Peripherals buses- ISA-PCIE, standards, comparison, usage 5. Architecture of microprocessor, types of architecture (RISC, CISC), ALU unit, control unit 6. Interior construction and principles of microprocessors, instruction set, instruction cycle, addressing,... 7. Memory, principles, classification,... 8. Harddisks and its structure, construction, principles, classification 9. Logical structure of harddisk, MBR, FAT, NTFS 10. Optical discs, physical principles, construction, classification 11. Display and graphical subsystem, principles, classification, CRT, LCD, parameters 12. Sound system of computer, principles of audio recording, digitalization, FM synthesis, wave table synthesis, sound files 13. Peripherals, keyboard, mouse, scanner, touchpad, printers 14. Computer interfaces, classification, USB, FireWire, PS/2 ...

Faculty/Institute:	Faculty of Science / Department of Informatics
Course title:	**Security Technologies**
Course code:	KI / BET
ECTS:	2
Level of course:	bachelor
Teacher:	RNDR. Jan Krejčí, Ph.D.
Term:	Winter semester
Language of instruction:	English
Lectures/exercises:	1/1 per week
Completion:	Pre-Exam
Course goal:	The course is designed as a basic introduction to the security field of information technology with an emphasis on basic concepts, methods, principles and techniques used in specific areas. Subject describes the system management data security, the types of analyzes and appropriate countermeasures. It analyzes different types and principles of threats, the most common defense / protection technologies including a general description of the basic methods of protecting data and information on the level of network and computer itself. Subject explains the certification process and the principles of eGovernment including a quality standards of information security management.
Abstract:	1. Information security - basic axioms, principles, classification, tools. 2. Information security management systems - services, methods, verification of security 3. Analysis of the threats and risks - assets, threats, vulnerabilities, risks, threats, countermeasures. 4 Contemporary threats of information technologies - types, techniques, options. 5 AAA framework - principles, classification, purpose, use. 6 Infrastructure PKI - basic axioms, dig. signature, hash functions, use. 7 Infrastructure PKI - dig. certificate, certificate authority. 8 Computer security - basic defensive / protective technologies, techniques, tools and methods. 9 Data security - the life cycle of data, data distribution, backup and deletion of data. 10 Principles of security and protection of data in a computer network (in the Internet). 11. Protocols and methods of security and of safety data in a computer network (in the Internet). 12. Data protection of wireless networks - principles, classification, use.

Faculty/Institute:	Faculty of Science / Department of Informatics
Course title:	**Digital Systems**
Course code:	KI / CIS
ECTS:	5
Level of course:	bachelor
Teacher:	doc. RNDr. Sergii Babichev, CSc., Ing. Petr Haberzettl
Term:	Summer semester
Language of instruction:	English
Lectures/exercises:	1/2per week
Completion:	Exam
Course goal:	The aim of the course is to acquaint students with the principles of operation and characteristics of the basic components of microcomputers and their connection to the bus system. The aim of the exercise is to master programming and development of simple applications.
Abstract:	1. Basic parts of microcomputers 2. Basic functions of microcomputers 3. Software tools and equipment for development of microcomputers 4. Development of microprocessors and microcomputers 5. Systems with multiple microprocessors 6. Standardization 7. Peripheral equipment of microcomputers 8. Application of microcomputers 9. Memory circuits 10. Support circuits 11. Serial communication - electrical standards, communication protocols, serial bus 12. Interrupt system

Faculty/Institute:	Faculty of Science / Department of Informatics
Course title:	**Database Systems**
Course code:	KI / DSY
ECTS:	5
Level of course:	bachelor
Teacher:	Mgr. Jiří Fišer, Ph.D., doc. RNDr. Viktor Maškov, DrSc.,
Term:	Winter semester
Language of instruction:	English
Lectures/exercises:	2/2per week
Completion:	Exam
Course goal:	Aim of this course is to gain basic theoretical knowledge of database systems design oriented to relational systems. Design of models combines three ways of data processing: conceptual modelling (ER model), database modelling (relational model using normal forms) and object-relational modelling (object oriented concept).
Abstract:	1. Basic principles and history of database systems. 2. Basic conceptions and principles (object, entity, attribute, relation, query, view). 3. Database systems architecture. 4. Conceptual data model (ER model). 5. Relational data model (entity, relation, integrity, domains). 6. Transformation of conceptual model into relational model. 7. Database design. 8. Normalization and denormalization of relational data model. 9. Database languages - SQL basics. 10. Database languages - DDL SQL, DML SQL. 11. Database languages - DQL SQL, DCL SQL. 12. Transactions and triggers, failure recovery. 13. Introduction to object-relational database design.

Faculty/Institute:	Faculty of Science / Department of Informatics
Course title:	**Data Storage and Processing**
Course code:	KI / DUL
ECTS:	6
Level of course:	bachelor
Teacher:	Mgr. Jiří Fišer, Ph.D., RNDr. Petr Kubera, Ph.D., Mgr. Květuše Sýkorová
Term:	Winter semester
Language of instruction:	English
Lectures/exercises:	2/3per week
Completion:	Exam
Course goal:	The objective of this course is to provide introduction into multidimensional databases and data warehouses and principles of data mining.
Abstract:	1. Basic principles of online analytical processing (OLAP) and online transaction processing (OLTP) 2. Architecture of multidimensional databases 3. Architecture of data models and data warehouses 4. Transformation of relational databases into multidimensional databases and data warehouses 5. Extract, Transform and Load (ETL) phase 6. Creation and accessing methods 7. Reports and client applications 8. Working with OLAP databases 9. Data warehouse development 10. Statistical principles of data mining 11. Data mining: physical and conceptual models 12. Data mining: algorithms, evaluation and verification of models

Faculty/Institute:	Faculty of Science / Department of Informatics
Course title:	**Dependability of Hardware Systems**
Course code:	KI / DHW
ECTS:	3
Level of course:	bachelor
Teacher:	doc. RNDr. Viktor Maškov, DrSc.
Term:	Summer semester
Language of instruction:	English
Lectures/exercises:	2/0per week
Completion:	Exam
Course goal:	The course gives introduction into the problems of HW system dependability. The course gives the knowledge of how to assess the reliability of hardware and gives the explanation of what reliability control means. More attention will be devoted to the fault-tolerance of hardware and to the reliable group communication.
Abstract:	1. Introduction to the problems of dependability of hardware. 2. Basics of terminology. 3. Measurement of reliability of HW. 4. Measures and metrics. 5. Measurement techniques. 6. Development of reliable HW. 7. Reliability control. 8. Fault-tolerance of hardware. 9. Redundant structures. 10. Fault trees. 11. Fault-tolerance of distributed systems. 12. Reliable group communication.

Faculty/Institute:	Faculty of Science / Department of Informatics
Course title:	**Dependability of Information Systems**
Course code:	KI / DEP
ECTS:	4
Level of course:	bachelor
Teacher:	doc. RNDr. Viktor Maškov, DrSc.,
Term:	Summer semester
Language of instruction:	English
Lectures/exercises:	2/1per week
Completion:	Exam
Course goal:	The course gives introduction into the problem of dependability of information systems. The issues of self-checking and self-diagnosis of computing systems will be explained in details during the given course. The main subject of the course focuses on the tasks of reliability and fault-tolerance of information system.
Abstract:	1. Introduction to the problems of dependability 2. Fault-tolerance of information systems 3. Techniques for providing fault-tolerance of information systems 4. Self-checking and self-diagnosis at system level 5. N-variant programming and object oriented programming 6. Exception handling in N-variant programming 7. Competing and cooperative concurrent systems 8. Conversation in distributed systems 9. Coordinated atomic actions 10. Dependability of distributed applications 11. Using groups of objects for providing fault-tolerance of complex systems 12. Dependability concepts with respect to malicious faults

Faculty/Institute:	Faculty of Science / Department of Informatics
Course title:	**Application of Internet**
Course code:	KI / API
ECTS:	1
Level of course:	bachelor
Teacher:	Mgr. Kamil Balín
Term:	Summer semester
Language of instruction:	English
Lectures/exercises:	1/0 per week
Completion:	Exam
Course goal:	Pitfalls and opportunities of modern Web technologies from the point of view of ordinary user and programmer are addressed (easy integration of services into own WWW interfaces and advantages of distributed solutions). Finally, the course highlights the potential safety hazards of modern Internet and basic principles of protection.
Abstract:	1-2. Modern Internet and its technologies (Web 2.0) 3-4. CMS (Contents Management System) 5. Social Web (social networks) 6. Internet privacy and rights 7. Semantical Web and a Web agents (Web 3.0) 8-9. Cloud services 10-11. Multimedia on Internet 12. Safe Internet

Faculty/Institute:	Faculty of Science / Department of Informatics
Course title:	**Dependability of Software Systems**
Course code:	KI / DSW
ECTS:	3
Level of course:	bachelor
Teacher:	doc. RNDr. Viktor Maškov, DrSc.
Term:	Summer semester
Language of instruction:	English
Lectures/exercises:	2/0 per week
Completion:	Exam
Course goal:	In the course, the basics of development of reliable software are given. The course gives the knowledge of how to assess the achieved level of reliability of software and explains what should be done in order to improve software reliability if needed. The students will be acquainted with the existing facilities used for modeling of software reliability. More attention will be devoted to the architectures of fault-tolerant software.
Abstract:	1. Introduction to the problems of dependability of software. 2. Basics of SW engineering. 3. SW verification. 4. SW validation. 5. SW reliability. 6. Tools for SW assessment. 7. Models of SW reliability. 8. Diagnosis of SW. 9. Architectures of fault-tolerant SW. 10. Diagnosis model of a SW system. Comparators and consistent set of units. 11. Tools used for developing a reliable SW. 12. Formal methods for developing a reliable SW.

Faculty/Institute:	Faculty of Science / Department of Informatics
Course title:	**Information and Communication Technologies**
Course code:	KI / ICT
ECTS:	2
Level of course:	bachelor
Teacher:	Ing. Pavel Kuba, Ph.D.,
Term:	Summer, winter semester
Language of instruction:	English
Lectures/exercises:	2/0 per week
Completion:	Pre-Exam
Course goal:	The course will provide students with competencies in three main areas, i.e. hardware, software and other IT skills, which could be used at work with computer and its administration. Students will acquire basic knowledge about PC components and will practice the use of the Office packages, Windows, Linux, and gain awareness of safety in the network, especially on the Internet. Competence in the area of software applied in the course will be practiced in seminary work. Students will also learn how to use the more advanced features of Office packages.
Abstract:	1. Introduction 2. The individual hardware components of a computer and work with them, work with computer peripherals, the safe use of a computer, computer network 3. Presentation of the currently used version of the operating system MS WINDOWS, orientation in the system, work with folders, system administration at the user level, basic programs, data compression 4. The Linux operating system, an overview of basic distributions, orientation in the system, live distribution, work in the console, stability, Linux compared to MS Windows 5. Software competence (MS WORD): basic font and paragraph formatting, bullets, numbering in the document, the creation of custom styles, creation of basic list (table of contents, list of figures, custom list), inserting images, tables and other objects, header, footer, use of partitions 6. Software competence (MS WORD): the creation of a coherent document such as seminar work, bachelor's thesis and letter, sharing document and mail merge 7. Software competence (MS EXCEL): basic settings and editing the document, the formatting of data in a cell, the creation and formatting of simple tables, using basic functions 8. Software competence (MS EXCEL): creating and formatting charts, effective work with data, conditional formatting, creation of charts using Gnuplot 9. Software competence (MS EXCEL): comprehensive data processing, statistical data processing, creation of schemas 10. Software competence (MS POWERPOINT): principles of making professional presentations, methods of presentation, appearance settings, text formatting, use of objects 11. Software competence (MS POWERPOINT): making professional presentations, and common mistakes 12. Other IT skills: a basic overview, safe use of public computer network, netiquette, news in the area of IT (hardware, software, applications) 13. Test

Faculty/Institute:	Faculty of Science / Department of Informatics
Course title:	**Internet Technologies and Protocols**
Course code:	KI / ITP
ECTS:	4
Level of course:	bachelor
Teacher:	RNDr. Jan Krejčí, Ph.D.
Term:	Summer semester
Language of instruction:	English
Lectures/exercises:	1/2 per week
Completion:	Exam
Course goal:	The course focuses on the application layer of TCP / IP model and its corresponding layers of the ISO/OSI reference model. Students in the lecture will become familiar with the most commonly used protocols and services on the Internet. Within the workshops, students will configure individual services and monitor computer communications, in which they will detect and analyze individual protocols and their packets.
Abstract:	1. Basic concepts, repetition of TCP / IP and reference model ISO / OSI 2. Description of the application layer and its functions 3. Transport layer protocols ISO / OSI - TCP, UDP 4. Records of relational layers ISO / OSI - PAP, SSL 5. Connecting to a remote console - TELNET, RSH, SSH 6. Connecting to a remote GUI - VNC, RDP 7. Sharing of data - FTP, NFS, SAMBA 8. Web services - HTTP, HTTPS 9. E-mail communication - POP3, SMTP, IMAP 10. Online Syndication - RSS, Atom 11. Protocol for real-time communication - IRC, Jabber 12. Configuration Protocol Network - BOOTP, DHCP, DNS 13. Protocols for transmission of multimedia and publishing - UPnP (DLNA), RTP, RSTP, RCTP"

Faculty/Institute:	Faculty of Science / Department of Informatics
Course title:	**Fundamentals of Computer Graphics and Multimedia**
Course code:	KI / MPG
ECTS:	2
Level of course:	bachelor
Teacher:	Ing. Pavel Kuba, Ph.D.,
Term:	winter semester
Language of instruction:	English
Lectures/exercises:	2/0 per week
Completion:	Pre-Exam
Course goal:	The aim of the course is to expand students' knowledge in the field of multimedia, their recording, playback and transmission. The course is focused on multimedia hardware and networking technologies, as well as on software processes that are necessary for processing of multimedia recordings.
Abstract:	1. Signal processing, antialiasing. 2. Light and color models (RGB, CMYK, HSV, YCBCR). 3. Multimedia hardware (sound card, graphics card, additional devices, optical and magneto-optical discs, display, print device, scanner). 4. Data compression. Types and compression algorithms. 5. Digital photography and image processing. Bitmap graphics. Formats. 6. Video recording and processing. File formats. 7. Audio recording and processing. File formats. 8. Compression standards for multimedia, MPEG. 9. Curves and surfaces (Hermite, Coons, Bézier, B-spline, NURBS). Vector graphics. Formats. OCR. 10. Streaming. Multimedia protocols, VoIP. 11. Applications for multimedia. 12. Application programming interface. OpenGL, DirectX.

Faculty/Institute:	Faculty of Science / Department of Informatics
Course title:	**Mathematical Software**
Course code:	KI / MSW
ECTS:	2
Level of course:	bachelor
Teacher:	RNDr. Zbyšek Posel, Ph.D.,
Term:	winter semester
Language of instruction:	English
Lectures/exercises:	2/0 per week
Completion:	Pre-Exam
Course goal:	The course is focussed on the introduction of the basic mathematical software-Matlab, Maple. The emphasis is put on the solution of problems of calculus, algebra and numerical mathematics.
Abstract:	1. Introduction to Matlab 2. Programming and plotting in Matlab 3. Matrices and matrix operation in Matlab 4. Function of one variable, Symbolic Math ToolBox 5. Integral calculus-numerical quadrature, Monte Carlo method 6. First semestral project 7. Limits and derivation of function of one real variable 8. Ordinary differential equations 9. Introduction to Mathematica 10. Programming in Mathematica and calculus tasks 11. Second semestral project 12. Interconnection between Matlab and Mathematica

Faculty/Institute:	Faculty of Science / Department of Informatics
Course title:	**Numerical Methods**
Course code:	KI / NME
ECTS:	5
Level of course:	bachelor
Teacher:	doc. RNDr. Sergii Babichev, CSc., RNDr. Petr Kubera, Ph.D., RNDr. Jiří Škvor, Ph.D.,
Term:	winter semester/ summer
Language of instruction:	English
Lectures/exercises:	2/0 per week
Completion:	Exam
Course goal:	Introduction to numerical mathematics for students of computer science.
Abstract:	1. Function approximation, Lagrange interpolation 2. Definition of spline function, interpolation via spline-construction, derivation 3. Numerical quadrature, Newton-Cotes rules 4. Romberg's quadrature method, Gaussian quadrature rules 5. Method for nonlinear equations, Newton's (Newton-Rhapson) method 6. Fixed point method, root finding for polynomials, Horner scheme 7. System of linear equation, conditional number, Gaussian elimination 8. LU factorization, Cholesky and QR factorization 9. Basic iterative methods for the solution of linear algebraic equations 10. Eigenvalues of matrix, power method 11. Numerical solution of ODE, one step methods, Runge-Kutta methods 12. Gradient methods

Faculty/Institute:	Faculty of Science / Department of Informatics
Course title:	**Object Oriented Design**
Course code:	KI / OON
ECTS:	3
Level of course:	bachelor
Teacher:	RNDr. Petr Kubera, Ph.D.
Term:	winter semester
Language of instruction:	English
Lectures/exercises:	1/0 per week
Completion:	Pre-Exam
Course goal:	This course is focused on object-oriented design and software analysis in UML. Students will become familiar with structural and behavioral view and appropriate UML diagrams. At the same time students will gain an overview of selected approaches and methodologies of software development.
Abstract:	1. Introduction into UML, overview of software 2. The basics building blocks of UML 3. Use case diagrams 4. Structural diagrams 5. Behavioral diagrams 6. Diagram of interactions 7. Software development approaches 8. Unified Process 9. Waterfall model 10. Prototype model 11. Extreme programming 12. Overview of another software development approaches

Faculty/Institute:	Faculty of Science / Department of Informatics
Course title:	**Professional English**
Course code:	KI / OAN
ECTS:	2
Level of course:	bachelor
Teacher:	
Term:	Winter, summer semester
Language of instruction:	English
Lectures/exercises:	2/0 per week
Completion:	Pre-Exam
Course goal:	The course is aimed at mastering specialist language in the field of Informatics and Computer Technologies. Students should gain good skills in understanding of spoken language and fluent speaking in situations they may encounter in their professional life, good orientation in technical texts. The course also aims at enhancing students' knowledge of grammar, great emphasis is laid on students' individual preparation.
Abstract:	1. Introduction. Studying It at the Faculty of Science 2. PC Architecture 3. IT Costs 4. Operating Systems 5. Enterprise Social Media 6. Networking 7. E-commerce 8. Programming 9. IT Solutions 10. Application Design 11. E-government 12. Test 13. Colloquy

Faculty/Institute:	Faculty of Science / Department of Informatics
Course title:	**Operating Systems**
Course code:	KI / OPS
ECTS:	2
Level of course:	bachelor
Teacher:	RNDr. Petr Kubera, Ph.D.,
Term:	Summer semester
Language of instruction:	English
Lectures/exercises:	1/1 per week
Completion:	Pre-Exam
Course goal:	The course is targeted to the basic principles of contemporary operating systems and to its internal structure, especially it is focussed on the Linux/UNIX systems. The topics covered in this course are working with shells, programming scripts, system configuration and administration.
Abstract:	1. OS architecture: file systems, users, processes, 2. Introduction to the system shells, working with files and directories 3. Introduction to file systems, structure, classification, properties, physical and logical volumes 4. Users and groups, permissions, management 5. Process management, priorities, signals, interprocess communication 6. Tools for text processing, pipes 7. Introduction to the scripting, conditionals, loops 8. System services, principles of services configuration 9. Network services and configurations (address, ports, web server, ssh server, mail server) 10. Network file systems 11. System software management, building programs, software packages and package managers 12. Data and system archiving management

Faculty/Institute:	Faculty of Science / Department of Informatics
Course title:	**Optimization**
Course code:	KI / OPT
ECTS:	5
Level of course:	bachelor
Teacher:	doc. RNDr. Sergii Babichev, CSc., doc. RNDr. Jiří Felcman, CSc., RNDr. Petr Kubera, Ph.D.,
Term:	Summer semester
Language of instruction:	English
Lectures/exercises:	2/2 per week
Completion:	Exam
Course goal:	This course provides an introduction to basic optimization techniques. We emphasise linear programming, including integer programming and selected methods for solving nonlinear problems. An integral part of the course is solving practical problems using appropriate software.
Abstract:	1. Mathematical properties of linear programming 2. Graphical solution of linear optimization problems 3. Primal simplex method 4. The duality theory in linear programming, the dual simplex method 5. The transportation problem, the assignment problem 6. Sensitivity analysis of LP 7. Integer programming (Gomory's cutting plane method, branch and bounds method) 8. Dynamic programming and application 9. Minimization in 1D (quadratic interpolation method, golden cut method, Fibonacci numbers method) 10. Nonlinear optimization problems without restrictions 11. Least squares method 12. Nonlinear optimization problems with restrictions

Faculty/Institute:	Faculty of Science / Department of Informatics
Course title:	**Parallel Programming**
Course code:	KI / PPG
ECTS:	5
Level of course:	bachelor
Teacher:	Mgr. Jiří Fišer, Ph.D., prof. Ing. Martin Lísal, DSc., RNDr. Zbyšek Posel, Ph.D.,
Term:	Summer semester
Language of instruction:	English
Lectures/exercises:	2/2 per week
Completion:	Exam
Course goal:	Introductory course in parallel programming is based on classification and description of parallel systems and their basic principles. The course is focused on SMP systems with shared memory using threads (OpenMPI, Parallel-LINQ), however both asymmetrical systems (GPGPU) and massive parallelism are presented as well. Parallel implementation of basic algorithms and operations are presented in seminars.
Abstract:	1. Principles and classification of parallel systems (Flynn's taxonomy, massively parallel systems, SMP). 2. Efficiency of parallelization (Amdahl's law, GustafsonBarsis' law). 3. Tasks and threads. Operating system support for parallelism. 4. Memory. Low-level access (caching). 5. OpenMP in C. 6. Practical application of OpenMP. 7. Parallel-LINQ and parallel tasks in C#. 8. Practical application of Parallel-LINQ. 9. OpenCL. 10. Practical application of OpenCL. 11. MPI. 12. Practical application of MPI. 13. Automatic parallelization.

Faculty/Institute:	Faculty of Science / Department of Informatics
Course title:	**Computer Graphics**
Course code:	KI / CGR
ECTS:	4
Level of course:	bachelor
Teacher:	Ing. Pavel Kuba, Ph.D.,
Term:	Summer semester
Language of instruction:	English
Lectures/exercises:	2/2 per week
Completion:	Pre-Exam
Course goal:	The course is devoted to the theory and algorithms of 2D and 3D computer graphics. The students are introduced to the following topics: drawing 2D elements, image processing, modeling the 3D objects and rendering the scene. Exercises are used to validate the discussed algorithms in the programming.
Abstract:	1. Drawing 2D elements; Bresenham algorithm 2. Area filling (scan-line fill algorithm, seed fill algorithm); clipping 3. Image editing; color space reduction, histogram 4. Noise reduction, sharpening, edge detection 5. Coordinate systems; geometric transformation, projections methods 6. Boundary, volumetric and procedural representation, solid modeling 7. Light and local illumination models 8. Shading methods (flat, Gouraud, Phong) 9. Problem of visibility, shadows (projection methods, shadow volume, depth buffering) 10. Textures 11. Radiance, rendering equation, radiosity 12. Global illumination models; ray tracing, photon maps

Faculty/Institute:	Faculty of Science / Department of Informatics
Course title:	**Practical Applications of Hardware**
Course code:	KI / AHW
ECTS:	1
Level of course:	bachelor
Teacher:	RNDr. Jan Krejčí, Ph.D.
Term:	Winter semester
Language of instruction:	English
Lectures/exercises:	2/2 per week
Completion:	Pre-Exam
Course goal:	The course is focused on the practical use of various hardware platforms to solve simple informatics projects. This course is divided into eight blocks. First seven of them are practised in the laboratory and are focused on the particular area of hardware resources. The last block is an excursion. Learning blocks are two-hour except for the first block, which is three-hour. The first block is complementary to the course Computer Architecture (KI/APC or KI/KAPC) and the other two blocks are complementary to the course Fundamentals of Computer Networks and Protocols (KI/ZPP or KI/KZPP). In the remaining blocks students gain basic skills in the field of digital systems, robotics and IT infrastructure. The content of each teaching block is updated according to current trends and development in information technologies.
Abstract:	1. Computer architecture - computer components 2. Fundamentals of computer networks and protocols - introduction to IPv4, switching and routing 3. Network management principles in practice - basic server services (DNS, DHCP, NAT, Firewall, etc.) and their configuration and construction of computer network 4. Simulation of digital circuits - logic circuits and their real world application 5. Applications of microcontrollers and field-programmable gate array (FPGA) - introduction to VHDL programming 6. Real time systems 7. Autonomous robotic systems - application of measurement of physical quantities and sensoric subsystems 8. IT Excursion - additional activity to the issue of computer networks focused on visit to a data centre

Faculty/Institute:	Faculty of Science / Department of Informatics
Course title:	**Computer Networks in Practice**
Course code:	KI / PPSI
ECTS:	2
Level of course:	bachelor
Teacher:	RNDr. Jan Krejčí, Ph.D.
Term:	Summer semester
Language of instruction:	English
Lectures/exercises:	2/2 per week
Completion:	Pre-Exam
Course goal:	This course is designed as practical introduction to routers and routing. In this course will be taught routers settings, routing protocols (RIP, EIGRP,...) and WAN networks problematics.
Abstract:	1. Routing and routing protocols 2. Connecting to router and basic settings 3. Administration of router 4. Static routes configuration 5. Dynamic routing protocols 6. Access-lists settings

Faculty/Institute:	Faculty of Science / Department of Informatics
Course title:	**Computer Technologies in Practice**
Course code:	KI / PPT
ECTS:	2
Level of course:	bachelor
Teacher:	Mgr. Kamil Balín
Term:	Summer semester
Language of instruction:	English
Lectures/exercises:	0/2 per week
Completion:	Pre-Exam
Course goal:	Laboratory classes provide students with experience in the area of computer hardware of type IBM PC and its accessories. Teaching takes place in laboratories in small groups. The aim of the course is to practice the knowledge acquired during theoretical lessons, especially in the course Computer Architecture. The main focus of the course is the construction of several types of computers, their configuration, installation of basic software and troubleshooting of hardware and software issues. The students will learn basic diagnostics and measurement of electrical quantities.
Abstract:	1. Design of a computer 2. Computer assembly 3. Security 4. Diagnostics, measuring physical characteristics (voltage, current, power, etc.) 5. Testing components 6. PC maintenance 7. Installing and configuring OS 8. Writing simple scripts OS 9. Backup OS 10. RAID 11. BIOS setup and flashing the BIOS, firmware 12. UPS 13. Solving problems

Faculty/Institute:	Faculty of Science / Department of Informatics
Course title:	**Computer Networks**
Course code:	KI / PSI
ECTS:	6
Level of course:	bachelor
Teacher:	RNDr. Jan Krejčí, Ph.D.
Term:	Winter, summer semester
Language of instruction:	English
Lectures/exercises:	2/2 per week
Completion:	Exam
Course goal:	The course focuses on layers L1, L2 and L3 of ISO / OSI reference model. The students will learn about the kinds of lectures transmission medium for data communication, active components in a computer network serving the switching and routing. In practical exercises they will try to model various tasks of routing protocols and routing, design of network addresses and their ranges, and not least the creation of virtual networks.
Abstract:	1. Revision of reference model ISO / OSI 2. Transmission media and connectivity 3. Addressing in networks (VLSM, CIDR) 4. Architecture of switches 5. Functions of L2 and L3 switches (STP, RSTP, MST) 6. Architecture of routers 7. Routing (static) and RIP routing protocol 8. Routing protocols EIGRP, OSPF 9. Routing in Wireless Networks 10. Solving problems in routing 11. Virtual networks and routing between them (VLAN, VPN) 12. Security of switches"

Faculty/Institute:	Faculty of Science / Department of Informatics
Course title:	**Principles of Operating Systems**
Course code:	KI / POS
ECTS:	3
Level of course:	bachelor
Teacher:	Mgr. Jiří Fišer, Ph.D.
Term:	Summer semester
Language of instruction:	English
Lectures/exercises:	2/0 per week
Completion:	Exam
Course goal:	The course is focused on basic principles of contemporary operating systems and on their internal structures, especially from the view of application programmers (i.e. at the level of kernel interface, e.g. POSIX and Win32).
Abstract:	1. Operating system architecture 2. Memory management 3. Memory virtualization 4. Shared memory 5. Task management (CPU scheduling) 6. Threading 7. Synchronization 8. Interprocess communication 9. I/O subsystem 10. File system 11. Operating system security 12. Operating systems and MIMD (SMP)

Faculty/Institute:	Faculty of Science / Department of Informatics
Course title:	**Hardware Programming**
Course code:	KI / PGH
ECTS:	3
Level of course:	bachelor
Teacher:	Ing. Petr Haberzettl
Term:	winter semester
Language of instruction:	English
Lectures/exercises:	1/2 per week
Completion:	Pre-Exam
Course goal:	Basic principles of programming of embedded systems (and all universal processors on machine-code level in general) are introduced. The course covers both universal approach and detail description of selected hardware embedded platform.
Abstract:	1. Architecture of processors (from programmer point of view) 2. Addressing (base and index registers) 3. Hardware interrupts 4. Bit-oriented memory access 5. Memory management 6. Programmable hardware device (ports, analog-to-digital converter etc.) 7. Assembler and machine code 8. Assembler - macros 9. Programming of embedded devices 10. High-level programming languages with support of hardware programming 11. Sensors 12. Actuators

Faculty/Institute:	Faculty of Science / Department of Informatics
Course title:	**Programming I**
Course code:	KI / PGL1
ECTS:	5
Level of course:	bachelor
Teacher:	Mgr. Jiří Fišer, Ph.D.
Term:	winter semester
Language of instruction:	English
Lectures/exercises:	2/2 per week
Completion:	Pre-Exam
Course goal:	Introductory course to programming which is focused on object oriented programming and basic algorithmization (procedural paradigm). Students become familiar with basic OOP concepts (object, class, methods) and procedural constructs (condition, loops). Basic classes of objects (numbers, booleans, strings), collections (lists, dictionaries) and I/O devices (streams) are also covered. The course is not based on particular programming language, but the utilization of OOP language with static typing, garbage collection and complete reflection (as Java or C#) is presumed.
Abstract:	1. basic concepts of object oriented programming (object, class) 2. elementary classes (numbers, strings, booleans) and their interfaces 3. class properties and methods (parsing strings, formatting) 4. variables (definition, assignment) 5. basic structure of program, procedural structures 6. text-oriented input and output 7. (extension) methods (parameter passing, return values) 8. list (indexation, iteration, duplication) 9. definition of classes (constructors, methods) 10. encapsulation (properties) 11. dictionaries (hash-based mapping) 12. byte- and character-oriented input and output (file streams)

Faculty/Institute:	Faculty of Science / Department of Informatics
Course title:	**Programming II**
Course code:	KI / PGL2
ECTS:	6
Level of course:	bachelor
Teacher:	Mgr. Jiří Fišer, Ph.D.
Term:	winter semester
Language of instruction:	English
Lectures/exercises:	2/2 per week
Completion:	Exam
Course goal:	Second part of introductory programming course develops students' skills in the field of practical object oriented programming. The core part of course is based on object polymorphism (provided by mechanism of shared interfaces and class inheritance) and its utilization in more complex application in form of standard design patterns. This course also covers some parts of standard libraries (GUI, regular expressions, XML processing) and principles of exceptions.
Abstract:	1. shared interfaces and polymorphism 2. singleton design pattern and class (static) attributes and methods 3. object creation (factory method design pattern) 4. modifications of interfaces (adapter and facade design pattern) 5. dynamic extension of object functionality (decorator design pattern) 6. class inheritance 7. utilization of inheritance and alternatives 8. UML class diagrams - global view of object system 9. separation of abstraction from implementation (bridge design pattern) 10. processing structured texts (XML, regular expression) 11. encapsulation of simple action and deferred processing 12. exceptional situations and exceptions

Faculty/Institute:	Faculty of Science / Department of Informatics
Course title:	**GUI Programming**
Course code:	KI / GUI
ECTS:	6
Level of course:	bachelor
Teacher:	RNDr. Petr Kubera, Ph.D.
Term:	summer semester
Language of instruction:	English
Lectures/exercises:	2/2 per week
Completion:	Exam
Course goal:	The objective of this course is to initiate the students to the concept of visual programming and event driven programming.
Abstract:	1. Event driven programming, delegates, events, design pattern Observer 2. Visual design of application, working with forms, dialogs. 3. SDA, MDA application, collecting data from forms 4. Working with XML, serialization, SOAP 5. Globalization and localization 6. Working with databases 7. Multithreading, visual multithreaded application 8. Usage graphics libraries (GDI+, DirectX, OpenGL, XNA) 9. Printing 10. User defined components 11. Reflection, plugins 12. Network applications

Faculty/Institute:	Faculty of Science / Department of Informatics
Course title:	**Internet Programming**
Course code:	KI / PIN
ECTS:	6
Level of course:	bachelor
Teacher:	doc. RNDr. Viktor Maškov, DrSc.
Term:	summer semester
Language of instruction:	English
Lectures/exercises:	2/2 per week
Completion:	Exam
Course goal:	The course focuses on the basics of XML technologies. More attention will be given to the development of XML files and to the XML Schema. While studying the course, the students will develop XML applications such as SVG (Scalable Vector Graphics) and SMIL (Synchronized Multimedia Integration Language). All the described technologies are the standards of W3C organization. It is assumed that students are already acquainted with basics of markup language XHTML, stylesheet CSS and protocols TCP/IP, HTTP which are needed to understand the issues of the course.
Abstract:	1. Basic Internet technologies and protocols 2. Markup language XHTML 3. Stylesheet CSS 4. Markup language XML - syntax, elements, attributes 5. XML - namespaces 6. XML/DTD (definition of legal elements of XML file) 7. DTD - using entities 8. DTD - directives "INCLUDE" and "IGNORE" 9. XML - Schema (XSD: elements, attributes, facets) 10. XML - Schema (XSD: indicators, element substitution, data types) 11. SVG 12. SMIL

Faculty/Institute:	Faculty of Science / Department of Informatics
Course title:	**Programming for Mobile Platforms**
Course code:	KI / PMP
ECTS:	2
Level of course:	bachelor
Teacher:	Mgr. Jiří Fišer, Ph.D.
Term:	summer semester
Language of instruction:	English
Lectures/exercises:	0/2 per week
Completion:	Pre-Exam
Course goal:	Course of programming on mobile platforms (i.e. smartphones, tablets) focuses on typical features of these platforms - prolonged life cycle, sandboxing, dynamic GUI and integration of hardware and software services. Specific platform may vary according to IT trends. The subject can be taught in Czech or English. This course has been created within the project CZ. 1.07/2.2.00/28.0296 "Intersectoral linkages and support practice in natural science and technical study programmes UJEP"
Abstract:	1) main principles 2) description of targeted platform 3) IDE and compilation chain 4) basic design patterns and idioms 5) application manifest and security 6) GUI principles 7) 2D graphics 8) internet services 9) geolocation 10) sensors 11) persistent storage and databases 12) preparation of seminar work

Faculty/Institute:	Faculty of Science / Department of Informatics
Course title:	**Project Seminar**
Course code:	KI / PROJ
ECTS:	5
Level of course:	bachelor
Teacher:	
Term:	summer semester
Language of instruction:	English
Lectures/exercises:	0/2 per week
Completion:	Exam
Course goal:	During the project seminar, students are grouped into smaller (3-5 members) teams and suggest smaller-scale projects and implement this project. Project topics are determined by teachers of various subjects, while the project can connect issues of more courses or even specialized modules (eg. Web service for corporate IS with the implementation of software and hardware deployment proposal). At project seminar students, among other, repeat the knowledge gained from the previous course Project Management and Enterprise Information Systems. Individual projects will be monitored at the seminars. The mutual exchange of information between individual teams provide feedback to each team. Beside the final product evaluation, the project documentation including analysis, design, schedule, etc. and long-term sustainability of the project (flexibility, scalability, technical documentation) is part of final mark.
Abstract:	

Faculty/Institute:	Faculty of Science / Department of Informatics
Course title:	**Theoretical Foundation of Informatics**
Course code:	KI / TZI
ECTS:	3
Level of course:	bachelor
Teacher:	Ing. Mgr. Jiří Barilla, CSc.
Term:	summer semester
Language of instruction:	English
Lectures/exercises:	2/0 per week
Completion:	Exam
Course goal:	In this course, students will learn the theoretical foundations of informatics, which are important for the study of information systems. Students will acquire basic knowledge of selected topics in mathematics (logic, sets, relations, combinatorics etc.), number systems, Boolean algebra, information theory, complexity theory, Turing machines and computability theory. The emphasis is on linking the mathematical theory with practical implementation. The acquired knowledge will enable students a better understanding of related subjects in the field of information technology.
Abstract:	1. The Basic Mathematical Ideas. 2. Propositional Logic. 3. Sets and Relations. 4. Relational Structures. 5. Mapping. 6. Number Systems. 7. Boolean Algebra. 8. Combinatorics. 9. Information Theory. 10. Complexity Theory. 11. Languages and Automata. 12. Turing Machines. 13. Computability theory.

Faculty/Institute:	Faculty of Science / Department of Informatics
Course title:	**Automata and Formal Language Theory**
Course code:	KI / AFJ
ECTS:	5
Level of course:	bachelor
Teacher:	Ing. Mgr. Jiří Barilla, CSc.
Term:	summer semester
Language of instruction:	English
Lectures/exercises:	2/2 per week
Completion:	Exam
Course goal:	In this course, students will learn the theoretical foundations of finite automata, grammars and pushdown automata. The emphasis is on linking the mathematical theory with practical implementation. The acquired knowledge will enable students a better understanding of the basic principles of computers designing and fundamentals of programming languages. Automata theory is closely connected with the theory of formal languages and therefore automata are often referred to as the class of formal languages that can be recognized.
Abstract:	1. The Basic Mathematical Ideas. 2. Finite Automata and Their Representation. 3. Recognize Languages by Finite Automata. 4. Nerod's Theorem. 5. Reduction of Finite Automata. 6. Realization of Finite Automata. 7. Nondeterministic Finite Automata. 8. Closure Properties of Regular Languages. 9. Regular Expressions and Languages. 10. Transcription Systems and Grammars. 11. Chomsky hierarchy. 12. Regular Grammars and Languages. 13. Context-Free Languages. 14. Pushdown Automata.

Faculty/Institute:	Faculty of Science / Department of Informatics
Course title:	**Introduction to Digital Systems**
Course code:	KI / UCS
ECTS:	2
Level of course:	bachelor
Teacher:	Ing. Petr Haberzettl.
Term:	summer semester
Language of instruction:	English
Lectures/exercises:	0/2 per week
Completion:	Pre-Exam
Course goal:	Introductory logic circuits course is focused on understanding the basic relations of logical systems and on the application of discrete mathematics. Students of this course will learn about the design of both combinational and sequential logic circuits. Sequential circuits will be designed using both asynchronous and synchronous methods. Students will also gain basic knowledge of the theory of finite automata and their application in sequential networks.
Abstract:	1. Boolean functions 2. Boolean expressions 3. Combinational networks 4. Minimizing the normal form expressions 5. Synthesis of combinational circuits 6. Mathematical models of behavior of sequential circuit 7. Finite state automata as a model for the behavior of an asynchronous sequential circuit 8. State assignment for sequential circuits and their minimization 9. Design of synchronous sequential circuits 10. Synthesis of asynchronous sequential circuits 11. Iterative circuits

Faculty/Institute:	Faculty of Science / Department of Informatics
Course title:	**Fundamentals of Economics**
Course code:	KI / ZEK
ECTS:	2
Level of course:	bachelor
Teacher:	RNDr. Jiří Škvor, Ph.D.
Term:	summer semester/ winter semester
Language of instruction:	English
Lectures/exercises:	2/0 per week
Completion:	Pre-Exam
Course goal:	In basic economics course for non-economic disciplines, students learn the basic concepts, approaches and paradigms of mainstream economics as well as marginally of behavioral economics with the main objective to know how to apply this knowledge in both professional practice and personal life.
Abstract:	A - Introduction to economics B - Microeconomics 1. market mechanism: supply and demand, market equilibrium 2. consumer behaviour: cardinal and ordinal utility theory 3. firm behavior: cost analysis in the short and long term 4. factors of production: labor market, capital market C - Macroeconomics 1. macroeconomic pentagon: economic growth, price stability, high employment, balanced public budgets, balance of trade 2. performance of the economy and its changes: indicators (gross / net domestic / national product) and methods of measurement, economic cycle 3. money, currency, price stability 4. analysis of (un) employment: classification, characteristics, consequences of unemployment 5. fiscal policy: tools and targets, the state budget (its function, structure, classification), taxes (tax systems, Laffer curve) 6. balance of payments and its structure D - Selected findings of behavioral economics

Faculty/Institute:	Faculty of Science / Department of Informatics
Course title:	**Fundamentals of Computer Networks and Protocols**
Course code:	KI / ZPP
ECTS:	3
Level of course:	bachelor
Teacher:	RNDr. Jan Krejčí, Ph.D., doc. RNDr. Viktor Maškov, DrSc.
Term:	winter semester
Language of instruction:	English
Lectures/exercises:	2/0 per week
Completion:	Exam
Course goal:	The course is designed as a basic introduction to computer wired and wireless networks. Attention will be paid to the development of computer networks with an emphasis on fundamental concepts and an overview of the various types of networks. The subject will describe the basic infrastructure networks and access methods used by the media. In this course we will discuss models of computer networks and the general fundamentals of network communication in routing, route selection methods and protocols. The course will also present selected classical network technologies in both wired and wireless networks.
Abstract:	1. History of development of networks, principles, use of basic concepts. 2. Classification of networks: basic terms, use, principles of operation. 3. Classification of networks: topology, node status, type and signal propagation. 4. Layer models of networks: principles, layers, protocols, services. Models ISO / OSI and TCP / IP: principle, layers, purpose, use 5. Transmission media: classification, use, survey frequency band used. Data transfers coding and modulation data. 6. Active elements in networks: classification, principles, data transmission. Network Infrastructure: purpose, basic division and recovery. 7. Access methods: purpose, methods, basic division, activities, examples of use. 8. Power Technology: Ethernet - data transmission, cabling, active elements, use. 9. Addressing the ninth over IP (line and network addresses, classes of IP addresses, CIDR, VLSM). Routing methods, hierarchical system, types of protocols. 10. Algorithm of vector distance, protocol RIP, (E) IGRP. Algorithm of state of connections, OSPF protocol. External routing protocols: BGP aggregation of routes. 11. IrDA and Bluetooth: technologies, standards, specifications, protocols, data transfer methods. 12. Wi-Fi: technology, channels, bandwidth, topology, components, applications. 13. Wi-MAX: technology, structure and model networks, possibilities of signal propagation. 14. GSM: development, subdivision, architecture, principles, data transfers."

Department of Mathematics

Faculty/Institute:	Faculty of Science / Department of Mathematics
Course title:	**Mathematical Analysis III**
Course code:	KMA / M102
ECTS:	4
Level of course:	bachelor, master
Teacher:	prof. RNDr. Jan Malý, DrSc.
Term:	Winter semester
Language of instruction:	English
Lectures/exercises:	2/2 per week
Completion:	Pre-exam credit
Course goal:	Theory of differential and integral analysis of functions of more variables, their usage in geometry and physics. Function series, their convergence, derivatives and integration, power series.
Abstract:	Continuity and limits of functions of more variables Deeper properties of partial derivatives, gradient Implicit functions and their derivatives Extrema of functions of more variables Extrema of functions of more variables (constrained) Integration of functions of more variables Riemann approach, relations to measures, other integrals Regular mapping, substitution in integrals of functions of more variables Application of integration of functions of more variables in geometry and in physics Function series, uniform convergence Derivative and integration of function series Power series

Faculty/Institute:	Faculty of Science / Department of Mathematics
Course title:	**Mathematical Analysis IV**
Course code:	KMA / M202
ECTS:	4
Level of course:	bachelor, master
Teacher:	prof. RNDr. Jan Malý, DrSc.
Term:	Summer semester
Language of instruction:	English
Lectures/exercises:	2/2 per week
Completion:	exam
Course goal:	Line and surface integrals and their applications, Fourier series and their calculus, Laplace and Fourier transform, calculus of variations.
Abstract:	Curves and surfaces Line integrals Green theorem Surface integrals Gauss-Ostrogradsky theorem Stokes theorem Potentials, applications to physics Fourier series Fourier integral and transform Laplace transform Calculus of variations, fixed end points problems Free end points problems

Faculty/Institute:	Faculty of Science / Department of Mathematics
Course title:	**Discrete Mathematics**
Course code:	KMA / P449
ECTS:	5
Level of course:	bachelor
Teacher:	RNDr. Martin Kuřil, Ph.D.
Term:	Summer semester
Language of instruction:	English
Lectures/exercises:	2/2 per semester
Completion:	exam
Course goal:	The major topics in this course include sums, recurrences, elementary number theory, binomial coefficients, generating functions. The goal is to become familiar with discrete operations.
Abstract:	1. Mathematical induction. 2. Numbers, powers and logarithms. 3. Sums and products. 4. Integer functions and elementary number theory. 5. Permutations and factorials. 6. Binomial coefficients. 7. Harmonic numbers. 8. Fibonacci numbers. 9. Generating functions.

DEPARTMENT OF CHEMISTRY

Faculty/Institute:	Faculty of Science / Department of Chemistry
Course title:	**General Chemistry**
Course code:	KCH / E100
ECTS:	4
Level of course:	Bachelor
Teacher:	RNDr. Jan Jirsák, Ph.D.
Term:	Winter + Summer
Language of instruction:	English
Lectures/exercises:	3/4 per week
Completion:	Exam
Course goal:	The aim of the course is to present modern chemistry and its historical context. Students will be acquainted with terms common to all branches of chemistry. Key topics of the course are: (i) chemical structure of matter, (ii) states, classification and properties of substances, (iii) fundamentals of thermodynamics and its application in chemistry, and (iv) reaction kinetics.
Abstract:	1. History of chemistry. Basic chemical laws and quantities. 2. Modern chemistry among other natural sciences and its division. 3. Structure of matter. Elementary particles and field. Atomic nucleus. Historical models of atom. 4. Quantum-mechanical model of atom. 5. Chemical bond. Structure and reactivity of molecules. 6. Intermolecular forces. 7. States of matter. Mixtures, solutions and colloids. 8. PVT behaviour of fluids. 9. Basics of thermodynamics. 10. Thermochemistry. 11. Phase equilibria. 12. Chemical equilibria. 13. Chemical kinetics. 14. Theoretical principles of modern analytical methods.

Faculty/Institute:	Faculty of Science / Department of Chemistry
Course title:	**Introduction to Inorganic and Organic Chemistry**
Course code:	KCH / E101
ECTS:	4
Level of course:	Bachelor
Teacher:	doc. Ing. Jan Čermák, CSc., RNDr. Václav Šícha, Ph.D., Mgr. Thu Huong Nguyen Thi, Ph.D.
Term:	Winter + Summer
Language of instruction:	English
Lectures/exercises:	3/1 per week
Completion:	Exam
Course goal:	The aim of the inorganic part is to acquaint students with topics related to the periodic table of elements. In this course we will discuss individual chemical elements, their occurrence in nature, chemical and physical properties, laboratory preparation, industrial production, important compounds and application. We will focus on chemical reactions of individual chemical elements and their compounds.
Abstract:	1. Periodic table of the elements 2. Basic elements and their chemical compounds (hydrogen and oxygen) 3. Noble gases, halogens, chalcogens 4. Boron group, carbon group, nitrogen group 5. Alkali metals, alkaline earth metals 6. Basic characteristic of metals, production of metals 7. Transition elements 8. Systematic IUPAC nomenclature. Alkanes and cycloalkanes 9. Stereochemistry 10. Haloalkanes. Nucleophilic substitution and elimination reactions 11. Oxidation-reduction in organic chemistry. Alcohols, ethers, and thiols, sulfides 12. Alkenes and alkynes. Addition reaction 13. Arenes. Electrophilic aromatic substitution 14. Aldehydes and ketones. Nucleophilic addition to the carbonyl group

Faculty/Institute:	Faculty of Science / Department of Chemistry
Course title:	**Applied Thermodynamics: Phase behaviour**
Course code:	KCH / E103
ECTS:	5
Level of course:	bachelor
Teacher:	Ing. Magda Škvorová, Ph.D.
Term:	Winter + Summer
Language of instruction:	English
Lectures/exercises:	2/2 per week
Completion:	exam
Course goal:	The aim of this course is to apply the theoretical knowledge of physical chemistry to solve various chemical-engineering problems. Modern PC software (EXCEL and MATLAB) and laboratory equipment are used to complete the courses.
Abstract:	1. Critical point, critical quantities and their estimation. 2. State behaviour: Introduction 3. Virial equation of state 4. Equation of state; Principle of corresponding states 5. State behaviour (SB) of fluids and empirical laws for SB estimation of mixtures 6. Thermodynamics: Introduction 7. Thermodynamics of the ideal gas; standard states 8. Thermodynamics of real gas: excess quantities 9. Heat and work determination 10. Partial molar quantities 12. Phase equilibrium: Introduction 13. Vapour-liquid equilibrium 14. Liquid-liquid and liquid-solid equilibrium; solubility of gases.

Faculty/Institute:	Faculty of Science / Department of Chemistry
Course title:	**Introduction to Chemical Engineering**
Course code:	KCH / E104
ECTS:	4
Level of course:	bachelor
Teacher:	Ing. Jaromír Havlica, Ph.D.
Term:	Winter + Summer
Language of instruction:	English
Lectures/exercises:	4/0 per week
Completion:	exam
Course goal:	This course provides a basic overview of the chemical engineering field. The main aim of course is understanding of processes occurring in the chemical and food industry. This includes the study of material and energy balances, thermodynamics, fluid mechanics, energy and mass transfer, separations processes, kinetics and chemical and biochemical reactors design. This course is built on a foundation in the sciences of chemistry, physics and biology.
Abstract:	1. Basic terminology. Mass and mole balance. 2. Balance of energy and enthalpy. 3. Balance of momentum. Flow fluids. 4. Filtration. 5. Mixing. 6. Heat transport by convection, conduction and radiation. 7. Heat exchangers. 8. Evaporators. 9. Mass transfer. Separation processes. 10. Liquid extraction. 11. Distillation. 12. Rectification. 13. Drying. 14. Chemical reactors and bioreactors.

Faculty/Institute:	Faculty of Science / Department of Chemistry
Course title:	**Experimental Methods: Laboratory Tutorials**
Course code:	KCH / E105
ECTS:	3
Level of course:	bachelor
Teacher:	Ing. Magda Škvorová, Ph.D.
Term:	Winter + Summer
Language of instruction:	English
Lectures/exercises:	0/3 per week
Completion:	exam
Course goal:	The aim of this course is laboratory experiments for determination of physico-chemical properties of pure substances or mixtures in liquid and solid states. These methods were previously theoretically presented in course Experimental and Non-experimental Methods in Physical Chemistry. Students will realize several laboratory experiments.
Abstract:	Overview of proposed experimental works (student should finish 10 of them depending on actual possibilities of individual experimental instruments) 1. Calorimetric study of enthalpy of solution, reaction and neutralization 2. Determination of dissociation constants of weak acids by several methods 3. Refractometry of pure compounds 4. Determination of density, viscosity and fluidity of pure liquids by several methods 5. Determination of density, excess molar volumes and refractive index of binary systems in temperature dependence 6. Determination of the critical point of ethane 7. Determination of electrokinetic potential and contact angle on solid surfaces 8. Determination of electrokinetic potential of colloidal system 9. Destilation curve of binary alcohol mixture 10. Determination of melting temperature of a pure substance and a mixture, determination of molar weight of high-molecular compounds 11. Chemical constitution of polymer foils by FTIR 12. Determination of metals in biological material by AAS 13. Determination of metals in biological material by chronopotentiometry 14. Usage of LCMS to analyze samples