DEPARTMENT OF POWER ENGINEERING

KEE/XARPS Automatisation, operation and control in electrical substations
doc. Ing. Lucie Noháčová, Ph.D.

The course deals with the function of the electrical substation from the point of view of control of the electricity system, the solution of control of electrical stations with and without operators, the role of the information and logical control system, the development of control systems based on technology, the solution of pre-emergency, emergency and emergency conditions, partial and complex automatisations and integration of control of electrical substations.

KEE/XAUS Analysis of steady states in electrical networks
doc. Ing. Pavla Hejtmánková, Ph.D.

The course deals with current, voltage and power output ratios in n-node electrical networks of various complexity and voltage levels, with theoretical analysis of load flow calculation, with optimization calculations of load flow, with solution of various operating and fault symmetrical and asymmetrical states, with calculation methods for solving of networks of various complexity levels and with application of mathematical methods to the solution of load flow calculation.

KEE/XDEE Electric Power Distribution
doc. Ing. Miloslava Tesařová, Ph.D.

The course deals with the distribution of electricity with respect to the design, operation and controlling of distribution networks, public as well as industrial ones. The course is focused on the following topics: network configurations, neutral arrangement and its impact on network operation, design and sizing of network elements, economical loading of feeders and distribution transformers, distribution system voltage regulation, quality of power supply, connection requirements and network disturbances caused by special loads and generating plants. The cource also responds to topical problems of the distribution systems, e.g. the impact of decentralized generation on the design, operation and control of distribution networks, implementation of new technologies.

KEE/XEPTZ Electric power engineering for fixed traction equipment
doc. Ing. Lucie Noháčová, Ph.D.

The subject includes the issue of electrical dependent traction in the current conditions of the Czech Republic. Emphasis is placed on SS and ST traction distribution devices, including traction lines. Students will get acquainted with practically modern trends in the field of fixed traction equipment, design of ČD traction line assembly for SS system 3kV and alternating system 25kV (public transport 650V and 750V), control of voltage and current ratios for individual types of el. traction, with ways of powering traction from the Energy System of the Czech Republic, including the resulting unsymmetry.

KEE/XJI Nuclear Engineering
prof. Ing. Radek Škoda, MSc, Ph.D.

The course deals with applied modern nuclear technologies; principles and specifics of their operation, benefits and use. It presents fission nuclear reactors, their types and historical development, physics related to them, materials of nuclear reactors, special technologies and new concepts. It describes nuclear power plants, primary and secondary circuit, scheme of nuclear power plants and details of individual structural parts and components, fuels and the influence and application of NPPs in the electrical system. Emphasis is placed on the safety of nuclear installations under applicable legislations. Other nuclear technologies are also presented (eg fusion technologies, particle accelerators, nuclear propulsion, military and space applications, use of ionizing radiation in medicine, industry and others). An overview of aspects of nuclear facility construction, licensing and economics is provided. The course also focuses on advanced calculations of reactor physics (diffusion and transport equations, nonlinear dynamics of nuclear reactors, advanced control of long-term reactivity). Students are acquainted with deterministic and Monte Carlo computational codes and specific application codes MCNP, Serpent and UWB1.

KEE/XMCM Monte Carlo Methods in Reactor Physics and Reactor Dosimetry
Ing. Martin Lovecký, Ph.D.

The course focuses on the advanced application of Monte Carlo methods in reactor physics and reactor dosimetry. It is designed to provide students with a comprehensive understanding of the principles, algorithms

and simulations used in nuclear engineering, particularly in the analysis of nuclear reactor design and operation and reactor dosimetry. The aim of the course is to equip students with the skills and knowledge necessary to conduct their original research and contribute to the development of nuclear technology and safety. The course describes the possibilities of Monte Carlo methods for criticality criticality, power distribution and transition processes for reactor physics and for calculations of neutron and photon flux density functionals for reactor dosimetry for determining neutron fluence, dose rates, radiation damage and neutron activation. The problem of generating random numbers and the variance reduction technique for the deep penetration radiation shielding problems. The preparation, visualization and transformation of nuclear data and their uncertainties into a format suitable for Monte Carlo calculations is presented. The subject further deals with the application of specific computational tools, creation and automation of input data and evaluation and visualization of output data for light water reactors, fourth generation reactors and small modular reactors.

KEE/XMPS Modeling of parts and elements of the electrical system
doc. Ing. Karel Noháč, Ph.D.

Subject deals with modern trends in mathematical and analog simulation in the field of power engineering at production, transmission, distribution and consumption of electricity. Including models of selected electrical equipment in modeling of the electrical system operating and fault conditions. Solution of special events (no-load conditions, small loads, overloads, short circuits, overvoltages, impulse currents, etc.) for symmetrical and asymmetrical, steady states and transient events and their responses in the operation and control of the electrical system.

KEE/XNRP Design and implementation of electroheat processes
doc. Ing. David Rot, Ph.D.

The course deals with designing and implementing electroheat processes, especially in induction heating, through current trends and technologies. The course aims to transfer students the necessary theoretical and practical experiences necessary to implement practical applications such as induction hardening, annealing, melting of metals, and metal oxides. From a theoretical point of view, students will get acquainted with the design of electrothermal processes in the environment of ANSYS ELECTRONIC DESKTOP (Maxwell 3D and ICEPACK) and Wolfram Mathematica. From a practical point of view, students will try the implementation of theoretically designed experimental processes.

KEE/XOPTE Optimization of thermal power plant operation
doc. Ing. Emil Dvorský, CSc.

The course deals with the analysis of the issue of increasing the efficiency of thermal power plants. Special emphasis is placed on verifying the possibilities of heat recovery into the heat recuperation and carnotization of the cycle, as well as reducing the power plant's own consumption.

KEE/XPJRC Nuclear Reactor Fuels and Nuclear Fuel Cycle
prof. Ing. Radek Škoda, MSc, Ph.D.

The course acquaints students with the basics of known nuclear fuel cycles, including the various processes that the fuel cycle involves and the basic physics. The course is also focused on innovated nuclear fuels and improving existing nuclear reactor fuels. The course describes all the steps of the military and civilian fuel cycle - the front end, irradiation of fuel and its storage and the back end of the fuel cycle. Operation of nuclear fuel processing equipment and materials produced by these equipment is also covered. Non-oxide nuclear fuels, their production and properties are presented. Emphasis is placed on the parameters and limits of current nuclear fuels and the possibilities of their improvement (thermal conductivity of fuels, its measurement and increase, zirconium coating of nuclear fuels and its corrosion, measurement of high-temperature oxidation Zr coverage and increasing the coating resistance). Students will get acquainted with the computational burnout code UWB1, its comparison with the codes MCNP and Serpent and calculations of high burnouts using the code UWB1. The course also deals with the study of burning absorbers in nuclear fuels, their use, calculations and ideal combinations.

KEE/XRREC Control and Regulation of Power Parts and Equipment
doc. Ing. Emil Dvorský, CSc.

Theory of automatic control in power industry and basic principles of linear servomechanisms. Transmission and utilisation of information in power equipment Appearing of disturbances on transmitting dates and their limitation. Utilisation of computers in power industry. Output and input parts for automatic equipment.

KEE/XSCHZ Power protection systems
Ing. Jana Jiřičková, Ph.D.

The course deals with the general theory of protection and security of electrical power system, determining the conditions for identification of emergencies and fault conditions, modern protection systems (digital protection, protection systems, peripherals), the issue of protection cooperation at different levels of protection and protection coupling systems, comprehensive design protections, their setting and adaptation to the protected equipment.

KEE/XSPES Reliability of Electric Power Systems
doc. Ing. Zbyněk Martínek, CSc.

Reliability of Electric Power Systems (KEE / XSPES)
Course deals with practical and theoretical information for ensure continual and reliable power supply to all demand places in required power and in required quality (with respects of ISO 9000 and ISO 14 000), due to customers' requirements, which is provided by electric power supply system in Czechia, reliability of electric power plants in Czechia, reliability of cogeneration production, definition of reliability metrics in power supply stations and power supply lines, modelling of elements and identification of failures at simple and advanced reliability systems, which do not repair after failure, modelling of elements and identification of failures at simple and advanced reliability systems, which repair after failure.

KEE/XTAPZ Theory and analyzes of electrical switching devices and equipment
Ing. Jan Sedláček, Ph.D.

The course is focused on electrical switching devices and equipment. It expands and deepens the theoretical basis for selected switching devices and equipment in connection with the applied physical phenomena and design solutions. Computational analyzes of the discussed devices and equipment using mainly numerical methods are connected to the theoretical basis. Depending on the equipment type, the analyzes include electromagnetic field, heat transfer, single and multiphase flow and their interactions. The course assumes the application of selected computational analysis on a model example.

KEE/XTEZT Theory of electroheat devices and electroheat technologies
doc. Ing. David Rot, Ph.D.

The course deals with the extension and deepening of fundamental theoretical knowledge in the field of conversion of electrical energy into useful heat (i.e., physical laws applicable to Joule heat, electromagnetic induction, electric arc, plasma, electron beams, and lasers) and the physical foundations of electroheat technologies realized in heating electrically conductive and electrically non-conductive materials. The course also focuses on computer modeling of physical phenomena arising during heating loads to choose the right type of heating and optimize technological heating. The course also contains principles for assessing electroheat devices' effects on the power supply network and the living and working environment.

KEE/XTVN High Voltage Techniques
doc. Ing. Eva Müllerová, Ph.D.

The course will explain the principle of insulation coordination as a tool for determining the requirements for electrical strength of equipment with respect to the operating conditions of the environment and the characteristics of protective elements used, key terms related to voltage tests and test laboratory equipment will be defined. Furthermore, the physical mechanisms of sparkover and puncture will be analyzed with respect to the application of knowledge in the process of assessing the electrical strength of equipment. Overview of systems for generating high alternating voltage, measurement and diagnostics of partial discharges, advanced methods of discharges evaluation. Design of circuits generating impulse voltage, transients on lines and their interaction with high voltage equipment, the effect of overvoltage shape on the behavior of insulation. Special types of impulse tests. Power supply unit for DC voltage tests. Systems for recording and evaluation of voltage stress tests, the importance of statistical processing of test results, the influence of the used test class on the explanatory power of the results. Selected high voltage applications – lightning protection, medicine, materials technology, automotive industry.

DEPARTMENT OF ELECTRONICS AND INFORMATION TECHNOLOGY

KEI/XCZS Digital Signal Processing
doc. Dr. Ing. Vjačeslav Georgiev

The doctoral student will gain knowledge in the field of digital signal processing, design of components enabling digital signal processing, signal processors (fixed and floating point), programmable logic arrays, discrete transformations (DFT, FFT), digital filtering. Typical digital signal processing applications are selected for illustration.

KEI/XEBI Electronics in Biomedical Engineering
Ing. Zuzana Petránková, Ph.D.

Biomedical signals characteristics, their time domain, amplitude, spectrum and requirements for their processing. Analogue circuits, amplifiers, specific parameters of analogue circuits for biomedical applications, analogue filtration, biomedical signals sensors and processing of their outputs, transmission of biomedical signals in analogue form. Sampling of analogue biomedical signals, conversion to digital form, specific parameters of converters for biomedical signals, digital filtering of biomedical signals, design of digital filters for medical applications, processing of biomedical signals in digital form, autocorrelation, spectral analysis, decimation, interpolation, transmission of digital biomedical signals, coding, modulation and telemetric transmission of biomedical signals. Adaptive systems in biomedical applications, identification of object parameters, stability. Electronic medical devices for direct measurement of one-dimensional biomedical signals, electrocardiograph, electroencephalograph, electromyograph. Systems for non-invasive measurement of some important physiological parameters, plethysmograph, pressure measurement, gas analyzers for the analysis of exhaled air, exercise testing principles and their evaluation. Safety requirements and electromagnetic compatibility requirements for medical devices. Medical imaging - principles, detectors, and electronics. Computed tomography, nuclear magnetic resonance, positron nuclear resonance, ultrasonography, sensing and measurement of surface temperatures (thermography), imaging of organs with an actively stored isotope (scintigraphy). Methods and electronic circuits for image processing, introduction to the theory of multidimensional discrete biomedical signal. Perspective electronic components for biomedical applications design.

KEI/XEFI Development of electronics for physics instrumentation
Ing. Petr Burian, Ph.D.

The course deals with the design of electronic system and software in physics instrumentation domain. From viewpoint of instrumentation, emphasis is put on detecting ionizing radiation, mainly on current modern hybrid pixel detectors. Also questions related to precise time measurement and synchronization are considered.In respect of electronics, the course is focused mainly on the design of system based on using programmable logic devices and modern SoC (System-on-Chip) devices. Students should get knowledge related to fast data processing in hardware resources and using fast serial communication interfaces. In course, the important trends of radiation hardened system are discussed as well. Students of this course can join the research UWB team and cooperate on real projects with our partners(CERN, IEAP CTU).

KEI/XEMCS Electromagnetic compatibility of electronic systems
doc. Ing. Jiří Skála, Ph.D.

The subject deals with theoretical and practical methods to achieve satisfactory electromagnetic immunity and low electromagnetic interference of electronic equipment. It focuses on the use of numerical methods and their application for calculations of electromagnetic compatibility problems. Presents knowledge for solving simulations of circuits with distributed parameters and modelling of the electromagnetic fields around various radio-frequency structures. It introduces the basic interference sources, interference couplings and method to eliminate them in the design and construction of electronic devices. It presents the most important recommendations, standards and suitable measuring and testing methods for electromagnetic compatibility. The main goal of the subject is solving of problems according to the topic of the doctoral thesis.

KEI/XENZ Electronic power supplies
doc. Ing. Jiří Hammerbauer, Ph.D.

The course deals with the power supply circuits of modern electronic systems. It contains mainly voltage and current switching power supply and systems, their design, simulation, construction and modern approaches to EMC issues, how to use PFC correction circuits and their topology. Emphasis is placed on the use of modern control circuits for switching power supplies from global manufacturers with practical implementation in

consumer and industrial electronics systems, including UPS backup systems for computer systems. Part of the course is devoted to charging the most commonly used batteries, their properties and methods of charging.

KEI/XES Electronics Systems

doc. Dr. Ing. Vjačeslav Georgiev

The scope of the subject is wide. The choice of topics and literature is individual and is discussed with students and their advisers. The student´s specialisation and supposed theme of future dissertation are respected.Survey of modern analog devices and their features. Stability, frequency responses, feedback corrections, thermal stability. Characteristics of signal in time and frequency domain. A/D converters suitable for control systems and for signal digitisation. Phase-locked loop. Frequency synthesis. Active filters. Switched-capacitor circuits. Noise and interference in analog systems. Simulation programmes, PSPICE.Survey of modern digital devices and their features. Theoretical issues of the analysis and synthesis of digital circuits and systems. Combinational and sequential circuits. Programmable logic circuits. Digital circuits and systems for signal processing. Systems with enhanced reliability. Fault tolerant backup systems. Principles of the design of bus-oriented systems. Interference in digital systems.

KEI/XKD Error Detection and Correction Coding

doc. Dr. Ing. Vjačeslav Georgiev

The doctoral student will gain theoretical knowledge in the areas of information theory, types of coding, security and self-healing codes, compression and cryptocodes. Anthropy as a measure of information. Communication channels. Binary linear codes. Hamming codes. Code construction. Reed-Muller codes. Cyclic codes. Generating matrices and polynomials. Control matrices and polynomials. BCH and Reed-Solomon codes. Convolutional codes. Encryption.

KEI/XMIS Microprocessor Systems

doc. Ing. Martin Poupa, Ph.D.

The scope of the subject is wide. The choice of topics and literature is individual and is discussed with students and their advisers. The student´s specialisation and supposed theme of future dissertation are respected.Computer circuits and systems. Single-chip microcomputers and microcontrollers. Internal circuits, their structure and use. Analog inputs/outputs. Special architectures - signal processors, processors for measuring systems. Multiprocessor systems, arbitration. Communication between microcontrollers, industrial buses. Programming of the tasks typical for control and signal processing in Assembler and C. Hardware and software reliability, redundancy, diagnostics.

KEI/XMMS Multimedia Systems

Ing. Ivo Veřtát, Ph.D.

Introduction to multimedia systems, physiology of perception of multimedia content, source signal compression, colorimetry and color spaces, acoustics and multi-channel sound systems, current development of multimedia technologies, measurement of technical parameters of multimedia systems, methods of digital processing of multimedia signals, methods of quality evaluation of multimedia content perception, digital radio broadcasting, digital TV broadcasting, analog and digital interfaces in multimedia. systems

KEI/XRA Radioengineering

Ing. Richard Linhart, Ph.D.

Radio-frequency electromagnetic field. Electromagnetic wave propagation. Radio waves. Information transmission. Antenna technology. Radio channel models. MIMO systems. Analog modulation. Discrete modulation in baseband and with carrier, QAM and OFDM systems. TDMA, FDMA, CDMA, SDMA, FH, spread spectrum systems. Source and channel coding. Design of radioelectronic systems. Components for radio engineering. RF amplifiers, linear circuits. Selective circuits. Non-linear circuits. Mixers. Modulators. Demodulators. Power radio technology, industrial applications. Receivers and transmitters. Digital signal processing. SDR, Cognitive radio. Satellite communication and navigation systems. GPS, Galileo. Mobile communication systems. Cellular systems. DECT, GSM, UMTS, LTE, 5G, UWB.

KEI/XSPLO Systems with programmable logic circuits

doc. Ing. Martin Poupa, Ph.D.

The subject deals with the design of modern electronic systems with programmable logic devices (HW and SW). The main focus is on methods and languages suitable for design of digital systems with FPGAs (synthesis and simulation). Applications are mainly focused on digital signal processing.

DEPARTMENT OF ELECTRICAL AND COMPUTATIONAL ENGINEERING

KEP/XAAEZ Acceleration of algorithms on embedded devices
Ing. Petr Kropík, Ph.D.

The course deals with the problem of accelerators of special algorithms for microcontrollers. During the study, the student will learn the problematic of accelerators (neural networks, optimization algorithms, audio or video accelerators) on the platform of microcontrollers. The student will be acquainted with the procedures for processing and transmission of image and sound at the level of microcontrollers. The student will also be acquainted with the principles of edge computing and offline programming on microcontrollers and with procedures for immediate data interpretation. Furthermore, during the study, attention is also paid to the robustness and stability of embedded solutions.

KEP/XED Classical Electrodynamics
doc. Ing. David Pánek, Ph.D.

The student will deepen their knowledge of theoretical electrical engineering in the course. They will get acquainted with advanced methods of analysis of electrical circuits and with the possibilities of their implementation. The student will learn methods for solving non-stationary problems in the field of circuits with distributed parameters (homogeneous lines, microwave circuits). They will also get acquainted with the principles of propagation and generation of electromagnetic waves in the open environment and in waveguides. Attention will be paid to understanding the connections between different types of description of physical phenomena (circuits with concentrated and distributed parameters, models based on the description of electromagnetic wave propagation).

KEP/XLEA Linear electromagnetic actuators
doc. Ing. František Mach, Ph.D.

Linear electromagnetic actuators for macro-and micro-systems for robotics and automation are the primary subject of the course. The curriculum is focused on fundamental physical principles, mathematical modelling and simulation, structural design, choice of materials, technological production processes and experimental verification. Students work on an individual project on the design, construction, and experimental validation of a specific electromagnetic actuator.

KEP/XMEP Electrothermal problems modeling
doc. Ing. Václav Kotlan, Ph.D.

The student will be acquainted with the formulation and solution of electrothermal problems. Special emphasis will be placed on the description of the sources of the temperature field and the boundary conditions. On practical examples of real problems, the student will get acquainted with the possibilities of associating individual physical fields and their mutual influence of electromagnetic fields, temperature fields and fields of thermoelastic or plastic deformations. During the study, the student will also learn the basics of working with simulation tools and formulating problems in them. An integral part of the course is the work with results, their analysis and the possibility of further development of problems, for example in the form of optimization techniques.

KEP/XOE Optimization in electrical engineering
prof. Ing. Pavel Karban, Ph.D.

The course deals with deterministic and stochastic optimization algorithms (gradient and simplex methods, evolutionary algorithms, algorithms inspired by nature). During the study, the student will learn concepts such as local and global extremum, classification and regression, and parameter space constraints. Sensitivity analysis and experimental design (random, factorial and stochastic schemes) are described and demonstrated on practical examples. Attention is also paid to surrogate models (linear models, Gaussian processes, random trees, neural networks), model validation and adaptive learning.

KEP/XPMSU Computer modeling of multiphysical problems
prof. Ing. Pavel Karban, Ph.D.

The student will get acquainted with the basic methods of mathematical modeling of physical fields and their subsequent computer implementation in available programs. During the study they will learn the description of the electromagnetic field, temperature field, field of thermoelastic deformations and field of incompressible fluid flow using partial differential equations and the formulation of the relevant boundary conditions. Special emphasis will be placed on partial models, their mutual interactions and numerical methods of their solution. Illustrative examples of typical combined tasks will be presented on specific technical assignments.

KEP/XRNE Robust design in electrical engineering
doc. Ing. David Pánek, Ph.D.

The course deals with methods of robust design of electrical devices. Within of the study of this course, students will get acquainted with the necessary basics of probability theory and statistics (conditional probability, Bayesian methods, probability distribution, associated probability), learn to perform sensitivity analysis, reliability analysis, get acquainted with the possibilities of using robust design techniques together with numerical models. (especially the finite element method) of the proposed devices. During the study, the student will use the tools of simulation software and write their own programs for analysis and evaluation of design robustness.

KEP/XTEMP Electromagnetic field theory
doc. Ing. Václav Kotlan, Ph.D.

Students in this course will deepen their knowledge of electromagnetic field theory - Maxwell equations for stationary and non-stationary field. They will get acquainted with mathematical modeling of stationary electromagnetic fields. They also learn about modeling of unsteady fields, boundary problems for vectors field and electrodynamic potentials, general procedures for calculating parameters (resistance, capacitance, self and mutual inductance), especially for 2D array, methods of calculation of forces in the electromagnetic field (from the Lorentz force, from the energy, from Maxwell's stress tensor), energy balance of electromagnetic field, Joule losses, Poynting vector and skin effect theory.

KEP/XVJ High-level languages for embedded applications
Ing. Petr Kropík, Ph.D.

The course deals with the principles of design of complex applications, their architecture and documentation, focusing on embedded applications and applications for electrical engineering. The student will be acquainted with the use of high-level programming languages optimized or compiled for microcontrollers. Attention will be paid to the design patterns usage applications creating process. During the study, the student will get acquainted with advanced algorithms and their implementation with a focus on the usage in a branch of electrical engineering. Advanced application architectures in the field of embedded development and its use will be described. During the study, the student will also be acquainted with the procedures ensuring robustness, stability and portability of microcontroller applications.

DEPARTMENT OF MATERIALS AND TECHNOLOGY

KET/XAK Acoustics
Ing. Oldřich Tureček, Ph.D.

The aim of this course is to provide the students with the knowledge of basic terms in acoustics, propagation of sound in space, basic types of sound sources and sound fields. Students will be introduced to methods of design and optimization of acoustic solutions and related measurement methods in acoustics.

KET/XDMS Diagnostics methods and systems
doc. Ing. Josef Pihera, Ph.D.

The course deals with methods and system of diagnostics of electrical machines and equipment. Students will get information in individual subsystems and diagnostic approaches of individual functional units of electrical machines, equipment. The main space will be devoted to understanding the subject of diagnostics in terms of machine operation strategy and will emphasize key diagnostic methods offline and online for collecting information about the properties of the diagnosed machine system, including innovative methods of acqusition, evaluation, data analysis and system behavior prediction. The study will also address the issues of decision-making processes in the implementation of diagnostic systems in the manufacture and operation of electrical machines, equipment and systems. The issues of new and special diagnostic procedures in the diagnostics of electrical machines will be discussed in terms of new requirements for the type of voltage, load and transmission of electrical energy. Suitable sensors and transducers for online diagnostics in power electrical engineering will be discussed. During the teaching of the subject, space will also be devoted to the issues of control of the diagnostic system in the operation of entire power units, in which diagnostics has a key role.

KET/XDPS Dielectric elements and systems
prof. Ing. Pavel Trnka, Ph.D.

The course is devoted to the study of physical principles in dielectric materials of gaseous, liquid and solid state. It is an explanation of ionization, polarization phenomena, both fast lossless and slow lossy polarizations,

their interpretation, the model of double potential well, interfacial - migration polarization and its detection using the PEA method, including a description of temperature and frequency dependences. Attention is also paid to the internal electric field in dielectrics, the principles of conductivity phenomena in gaseous, liquid and solid insulators, complex permittivity and the behavior of the dielectric in an alternating electric field, including the issue of dielectric losses. Furthermore, the issue of Townsend and streamer discharge and the mechanisms of electric flashover and breakdowns are discussed. Students will gain a comprehensive knowledge of the physical processes taking place in dielectric materials under in the action of ionizing agents and electric fields.

KET/XET Electrotechnology

prof. Ing. Pavel Trnka, Ph.D.

The course provides an overview of production technologies used in the production of various subsystems of electrical equipment and machines, such as rotating machines, transformers, or various elements and materials for high-voltage equipment. The individual technologies of the production of electrical insulation systems are considered. Special knowledge from the field of technological processes of electrical equipment production is applied, including specific applications and typical representatives while respecting reliability and dimensional limits. Elements and materials are evaluated in terms of their technological properties, behavior during processing and operation concerning the context of their internal structure and the resulting parameters.

KET/XFE Physical electronics

doc. Ing. Tomáš Blecha, Ph.D.

The course is focused on the physical principles of conductive, semiconductor and dielectric materials with a focus on the crystal structure of solids, defects in crystals, the atom model, atom bonds and band energy models. Particular attention is devoted to the study of physical phenomena in semiconductor materials with respect to the construction of basic electronic components. Furthermore, the physical principles of passive electronic components realized not only by standard technologies but also by promising technologies designed for flexible and printed electronics. The course also deals with optoelectronic and electro-optical properties of semiconductor materials and the basic principles of optical communication.

KET/XKPS Contact and Interconnection Structures

doc. Ing. František Steiner, Ph.D.

Application of contact and interconnection structures in the production of electronic assemblies. Chip connection technology (first-level packaging) - thermocompression, ultrasonic and thermosonic bonding, flip chip technology, and more. Second-level packaging. Types of joints - mechanical, metallurgical and glued. Soldered joints - formation of soldered joints, physico-chemical processes, surface tension, wettability, spreadability, capillarity, intermetallic layers, diffusion. Types of solders, fluxes, solderability testing, properties of soldered joints. Methods of machine soldering - wave, reflow, vapour phase, laser, pulse (resistance) and more. Ecological aspects - lead-free soldering technologies, lead-free alloys.

KET/XMAT Materials and technology

prof. Ing. Radek Polanský, Ph.D.

The course provides an overview of materials used in electrical devices with a focus on their properties and function. The description of the selected materials is further supplemented by (i) a group of materials for special purposes, which are at present indispensable for the management and operation of a functional electrotechnical units and (ii) description of application possibilities of individual materials.

KET/XMOP Modeling and Optimization of Technological Processes

doc. Ing. Jiří Tupa, Ph.D.

Basic approaches to modeling of technological processes, mathematical and object modeling. Overview of methods based on graph theory and their applications, balance models, object modeling of processes, used methodologies and modeling languages. Mathematical methods for process optimization, optimization algorithms, methods of industrial engineering. Computer support and simulation options.

KET/XMSD Measuring systems, data acquisition and signal conditioning

doc. Ing. Tomáš Blecha, Ph.D.

Measuring chain - elements, topology, interaction with the DUT and the environment, the EMI influence. Features, errors, uncertainties – calculation, superposition and propagation in the measuring chain. Measuring systems – basic topologies and implementation, PC instrumentation, features and use. Control of the measuring systems – serial and parallel buses. Signals – parameters and characterization. Analogue and digital signal conditioning. Basic design rules of the data acquisition systems. Circuits for signal conditioning used for measurement of various quantities. Measuring amplifiers and transducers.

KET/XMTUT Sustainable technology management in electrical engineering
doc. Ing. Jiří Tupa, Ph.D.

The aim of the subject is to introduce students to the basic principles of sustainable development management in the context of technological developments in electrical and electronic engineering. The subject will be divided into two parts. The first part will be of a general scope with the aim of introducing students to the basic topics of sustainable development, including legislative and economic aspects. In the second - specific - part, students will solve a case study in more detail with respect to the dissertation topic.

KET/XNVE Design and evaluation of experiments
doc. Ing. František Steiner, Ph.D.

Metrological system in the Czech Republic. Uniformity and accuracy of meters and measurements, basic measuring units, other units and their correct marking. Measurement errors and uncertainties, their causes, analysis. Propagation and calculation of uncertainties. Theory and planning of experiments, statistical analysis of one-dimensional data (estimates of parameters of selected distributions, estimates of position and scattering parameters, their robust estimates), analysis of small samples, testing of statistical hypotheses, statistical analysis of multidimensional data (characteristics of multidimensional random variables, verification of normality), methods of analysis of variance (factor analysis), testing of outliers.

KET/XOEL Plastic electronics
prof. Ing. Aleš Hamáček, Ph.D.

The course deals with problems of prospective organic materials for electronics. The main attention is focused on the organic molecular structures, doping of organic materials, charge transfer in molecular structures, basic electrical and optical properties. Applications are focused on organic conductors for microelectronic applications, semiconductor and optoelectronic devices, solar cells and environmental sensors based on organic compounds.

KET/XPESP Components of electrical systems and operational environment
prof. Ing. Pavel Trnka, Ph.D.

The course is devoted to the description of the relationship of individual elements of electrical systems to the operating environment in which they perform their function. The degradation of materials due to the influence of the surrounding, technological and operational environment will be considered in the course, as well as the reverse negative effect of individual elements on the environment and the human organism. Methodologies for estimating the future state using aging models are described. The content of the course is the practical application and work with aging models, the principles of determining their parameters, and the relationship to online diagnostics. The use of life modeling in long-term asset management of electrical equipment and life management is discussed.

KET/XRP Process Control
doc. Ing. Jiří Tupa, Ph.D.

Industrial process management principles and theory. Representation of processes attributes; structure and parameters of systems representing the management of activities and functional units. Specification of management objectives, structural aspects of systems, their orientation. Principles of hierarchical and decentralized management. Process, its properties, environment, identification, description, analysis and synthesis of the process. Process design, evaluation, and monitoring.

KET/XSAS Signal analysis of electronic components and interconnection structures
doc. Ing. Tomáš Blecha, Ph.D.

The course deals with time and frequency representation of signals, methods of signal transformation, energy and signal power, representation of signals in continuous and discrete time with a focus on analysis of signal integrity of interconnection and contact structures and electronic components, especially in the high frequency range. The course is focused on the study of the influence of materials and production technologies on signal transmission and processing. The issue of measuring and evaluating high-frequency signals in the time and frequency domain is also solved.

KET/XSDM Structural diagnostic methods
prof. Ing. Radek Polanský, Ph.D.

The course focuses on the description of the application of advanced diagnostic methods in electrical technology diagnostics - structural analyses. Students will get acquainted with the fundamental aspects related to measurement using these methods, their classification, advantages and disadvantages. In more detail, the content of the course contain the description of separating techniques (GC, GPC), spectrometry techniques

(IR, FT-IR, XRF) and in particular a group of thermal analyzes (DTA, DSC, TG, TMA, DMA). The described methods are suitably complemented by practical examples of their application.

KET/XSPEZ Reliability of electrical equipments
doc. Ing. František Steiner, Ph.D.

The course is focused on acquaintance with basic concepts and calculations in the field of theory of reliability. A necessary step towards applying computational methods and models is the definition of reliability indicators based on probabilistic estimates. Special attention will be paid to the normal, exponential, and Weibull distributions. However, they will also be included other distributions of continuous and discrete random variables. Students will also get acquainted with statistical tools used to analyze the equipment's state or model the time to product failure, including hypothesis testing, correlation, and regression analysis. Another area focuses on using graphical methods for reliability assessment, e.g., fault trees (FTA) and event trees (ETA). Attention is also paid to the issue of quality in electrical production and tools to ensure the reliability of operation and production, including evaluating the efficiency of production equipment. Students will also get acquainted with the possibilities of determining the lifetime based on the applied accelerated aging.

KET/XSPP Gas sensors
Ing. Petr Kuberský, Ph.D.

The subject is focused on various gas detection principles (optical, electrochemical, electric, mass-sensitive, thermometric, etc.) with the detailed description of both receptor and transduction mechanisms. The attention is also paid to selected analytical techniques for detection of chemical substances in gas phase. From the practical point of view, new trends in production technologies and innovative organic/inorganic sensitive materials are addressed.

KET/XTECH Technology of electronics
doc. Ing. Jan Řeboun, Ph.D.

The course deals with technologies and materials for the production of passive and active electronic components, printed circuit boards and electronic assemblies. It solves methods of production of conventional components as well as new types of components, monolithic and hybrid integrated circuits, including methods of their assembly. Materials and methods of production of single and multilayer printed circuit boards are solved, including detailed principles of surface and volume differentiation, ie methods of generating and transmitting patterns. In the field of printed circuit boards, HDI or microvia technologies are discussed. The issue of encapsulation of classic and modern components and modules, solution of terminals, contacting and assembling, technical and operational conditions of components are solved. Thick-film and thin-film production technologies, surface protections, testing and inspection with emphasis on methods of increasing reliability are solved. The course also deals with the production and operating environments, environmental cleanliness, ESD issues and diagnostics and analysis of failures of electrical components, substrates and assemblies.

KET/XTET Technologies for e-textiles
doc. Ing. Radek Soukup, Ph.D.

This course aims to provide doctoral students with detailed information about production technologies and processes of electronic textiles, their use and the current state in the field of standardization and harmonization of smart textiles. Attention will be focused mainly on textile sensors, antennas, detection fabrics, interconnection structures, advanced production technologies for smart textiles, hybrid integration, and conventional components' encapsulation into flat and linear textiles. The emphasis will also be on smart protective clothing, gloves and footwear e-textiles for medical purposes and smart industrial textiles in terms of target applications.

KET/XTFE Printed and flexible electronics
doc. Ing. Jan Řeboun, Ph.D.

The course deals with new technologies and materials enabling the realization of electronic components and systems on flexible, stretchable or uneven substrates. Attention is focused on the additive deposition methods for the realization of interconnection, contact and component structures with the emphasis on advanced printing techniques. The course also deals with technologies for structural electronics, fully digital electronics production and materials and technologies for biodegradable electronics.

DEPARTMENT OF POWER ELECTRONICS AND MACHINES

KEV/XEKNF Electromagnetic compatibility in low frequency phenomenon
prof. Ing. Václav Kůs, CSc.

Active, reactive, deformation power. Power factor. Classification of disturbances. Rectifiers, pulse rectifiers, frequency converters: harmonic currents of these converters. Amplitude and generalized amplitude law. Network impedance, harmonic voltages. Power factor compensation and filtration devices - filters, compensation. Dynamic power factor compensation. Measurement of harmonic voltages and currents. Simulation of EMC issues. EMC and standards. Active serial and parallel filters. Influence of semiconductor converters on powered devices. Investigation of the inverter - cable - motor system.

KEV/XEPO Electric Drives
prof. Ing. Zdeněk Peroutka, Ph.D.

This PhD course deals with a mathematical modeling of electric drives. The course also introduces in detail the power circuits and modern control methods of electric drives, mainly with ac motors. The attention is also paid to specific problems in power electronics converter fed drives as drive stability, drive impact on either power supply or load.

KEV/XETR Electric Traction
Ing. Martin Janda, Ph.D.

Traction mechanics and kinematics. Losses and power parameters. Traction characteristics. Power supply systems. Types and sources of interference and its reduction. Traction drive and traction motors. Methods of torque and speed control (traction, brake) for DC and AC systems. Vehicles with asynchronous traction motors. Multi-system vehicles. Auxiliary drives of vehicles. Vehicle testing. Information for driving a vehicle. Mechanical brake. Adhesion. Automatic vehicle control and the use of processor technology. Specific design of vehicles.

KEV/XMRP Microprocessor Control of Electric Drives and Power Electronics Converters
prof. Ing. Zdeněk Peroutka, Ph.D.

This PhD course deals with the modern digital (microprocessor-based) control units – their HW as well as SW. The main attention is paid to the control strategies of electric drives and power electronics converters and their implementation in the microprocessor-based controller. This course also covers the communications and diagnostics of the drive/vehicle system and rapid prototyping and testing of the new applications.

KEV/XMSPA Modeling and simulation in industrial applications
doc. Ing. Vladimír Kindl, Ph.D.

The aim of the course is to teach students to apply the finite element method to electromagnetic calculations in the field of industrial applications. The student will acquire the ability to simplify complex 2D / 3D models by removing irrelevant details, identifying the appropriate symmetry and choosing the appropriate solver. The student will also learn to extract important operating properties such as losses, current loads, force effects and parasitic parameters (R, L, C). Emphasis will be placed on using FE models in system simulations (e.g. electric motor, or transformer powered by an inverter, etc.), which allow to analyse the system as a whole.

KEV/XMSU Machine learning methods in electrical engineering
prof. Ing. Václav Šmídl, Ph.D.

The aim of this course is to introduce machine learning methods that are suitable for common tasks in electrical engineering: regression tasksa including non-linear ones, neural networks including deep networks, data interpolation using stochactic processes, efective global optimization via Bayesian optimization, representation of uncertainty using Monte Carlo methods (such as Hamiltonian MC) or variational approach. These methods are commonly used in artificial intelligence research but their use in electrical engineering is rare. The methods will be introduced on trivial examples for all attendees and extended to real application in induvidual consultations.

KEV/XMVE Mechanical computation in electrical engineering
doc. Ing. Miroslav Byrtus, Ph.D.

Acting of electro-magnetic forces in parts of electrical machines and electrical devices. Compensations of arising forces. Design and strength of rotors of electrical machines. Lateral and torsional vibration as a consequence of megnetic pulls Vibration of houdsings of electrical machines. Dynamic stress of transformators structures in limit cases (e.g. due to short circuit currents). Strength of bandage of electric machines (turbogenerators, machines with permanent magnets, dc machines). Eigen-frequencies and eigen-modes in

electrical devices. Modelling of mechanical components using finite element methods. Modelling of dynamic behaviour and dynamic analysis.

KEV/XNRS Design of electric drives and converters control
doc. Ing. Jakub Talla, Ph.D.

This PhD course deals with modelling and design of real-time control systems for electric drives and power converters by model based design methodology. More specifically, the course is focused on modelling of controlled physical systems and control circuits (analog and digital) with direct impact to control algorithms. For example, the course covers modelling of: nonlinear effects of converters and motors, microcontroller peripheries (A/D converters, PWM etc.), impacts of signals discretization, digital filtering, fixed-point calculations, latencies, noises etc. The second part of the course deals with design and testing of control systems and algorithms by Model In the Loop (MIL), Software In the Loop (SIL) and Hardware In the Loop (HIL) techniques and automatic code generation tools.

KEV/XPMA Advanced control methods for electrical engineering applications
prof. Ing. Václav Šmídl, Ph.D.

The aim of this subject is to introduce selected advanced control techniques such as adaptive linear quadratic control, predictive control, and approximate dynamic programming (including neuro-control and reinforcement learning) as tools for design of optimal control strategy. Some of these techniques are well established in other fields but their application in electrical engineering is just at the beginning. The methods will be explained on simple tutorial problems and further developed according to the focus of each student.

KEV/XRES Control of Electromechanical Systems
prof. Ing. Zdeněk Peroutka, Ph.D.

This PhD course deals with selected problems from the control theory of electromechanical systems with the main emphasis given on the control of electric drives and power electronics converters and power systems. This course also covers the identification/estimation of the parameters of electromechanical systems ("sensorless control" – model-based strategies, the application of different types of estimators (filters), artificial intelligence, the utilization of anisotropies, etc.).

KEV/XRVES Control of Grid Connected Converters
doc. Ing. Jakub Talla, Ph.D.

This PhD course deals with design of control systems for grid connected converters. The course objectives are: 1) Modelling of power converters and filters interactions with the grid, 2) Design of algorithms for grid synchronization based on DFT, SDFT, PLL, FIR filters etc., 3) Design of control algorithms in rotating and stationary reference frames based on PI, PR, LQ, FCS-MPC controllers 4) Control of grid quantities: active/reactive power control, active power filtering, negative/zero sequence control, droop control etc. 5) Real-time grid parameters identification

KEV/XSES Design of Electric Machines
doc. Ing. Karel Hruška, Ph.D.

The subject is supposed to extend the knowledge of Design of Electric Machines. Magnetic circuits of electric machines, problems of their construction, usage of numerical methods to their design, losses and possibilities of their limitation. Windings of different types of electric machines, specific properties and effects on the work of the machine. Arrangements for limitation of harmonic components, effects of partial discharge and overvoltage effects. Optimization of fundamental dimensions, mass and efficiency. Parasitic effects and their limitations Magnetic pull and its calculation. Optimization of machine parameters for optimal control. Special constructional solutions of electric machines – outer rotors, axial machines. Calculation methods for special winding types of electric machines. Polyphase electric machines – winding connection, possible injection of higher order harmonic components and effects on the design of the magnetic circuit.

KEV/XSMS Statistical methods for estimation of uncertain systems
prof. Ing. Václav Šmídl, Ph.D.

The aim of this subject is to teach theory and application of statistical tools that can be used to estimate systems with unknown parameters, unknown state of structure. The basic model to study is linear regression, which is the basis of the least squares method, however it can be used to model more advanced tasks such as structure estimation. Further topics of the subject are: (i) elicitation of unknown model from the measured data, (ii) Monte Carlo methods, and (iii) methods of recursive state estimation, for example application of Bayesian filtering in electrical engineering and communications.

KEV/XSMVE Special Converters of Power Electronics
doc. Ing. Martin Pittermann, Ph.D.

The course deals with special types of high-power power semiconductor converters. Specifically, multi-level converters (especially three-level voltage inverter and rectifier), direct frequency converters (both matrix converters and cycloconverters) and special aspects of other types of converters (thyristor rectifiers and converters with current intermediate circuit) are solved here.

KEV/XTES Theory of Electrical Machines
doc. Ing. Bohumil Skala, Ph.D.

The students are competed to master theoretical field in sphere of electrical machines. The checking of the differences between model and real product. The concrete contens of this suject may be adjusted with respect to student's study curriculum. Courses of study"1. Generalised approach to fields and forces, electromagnetic torque, induced voltage2. Transformers influence of the unsymmetrical conditions. Sudden short circuit .3. Mathematical models of asynchronous machines, transient and failure conditions.4. Synchronous machines in phasor and d-q component form, transient and subtransient conditions.

KEV/XTPF Space-Vector Theory in Electric Machines
doc. Ing. Karel Hruška, Ph.D.

Space-vector theory as an analogy to complex numbers analysis used for AC circuits. Space vectors, their geometric and physical meaning. The usage of Fourier analysis for the description of electromagnetic phenomena in the air gap. The current layer of one conductor and its Fourier series. The superposition of waves of all conductors of one phase. Resulting waves as sums of all phases. Space phasor of magnetic flux in the yoke of the machine and its symbolic representation. The inductance of one conductor as a base for determination of mutual inductances and magnetizing inductance in effect of all machine phases. The introduction of complex winding factor and its periodicity for higher order harmonic components. The transformation of space-vectors from any coordinate system to a different one. Optimal choice of a coordinate system for different types of electric machines of different control strategies. The working wave of a magnetic field in the air gap and unwanted effects of higher order harmonic components. Space vector theory as a general method for unified analysis of steady state and transient phenomena in electric machines considering higher order harmonic components of the magnetic field. Power supply from semiconductor converters, work into rectifier load. Torque of the machine. The equation of different types of machines expressed using space vectors as a general help for solution of their properties in steady state, quasi stationary and transient phenomena. Expression of mathematical models of induction and synchronous machines. Solution of non-symmetric electric machines and non-symmetric states of symmetric electric machines. Stability of electric machines.

KEV/XTVE Thermal and cooling calculations in electrical engineering
doc. Ing. Roman Pechánek, Ph.D.

Cooling techniques for electrical machines and power electronic devices. Hydraulic calculations, pressure sources, determination of pressure losses, optimization of cooling systems. Systems and fans for forced refrigerant circulation. Intensive methods of cooling electrical machines and power equipment in electrical engineering, cooling methods, types of coolers, heat pipes, and more. Transient thermal states of complex electromechanical systems. The solution of transient thermal processes in various load cycles of electrical machines and power equipment in electrical engineering. Cooling of power electronic components and heat transfer on printed circuit boards, types of cooling.

KEV/XVFS Multiphase Systems in Electric Drives
doc. Ing. Tomáš Komrska, Ph.D.

The course objectives are multiphase systems in the field of power electronics and electric drives. Main attention is paid to generalized Clarke's transformation for multiphase systems, generation of rotating field using basic and higher harmonic components, connection of multiphase drives, vector control of multiphase electric drives, space vector modulation techniques of multiphase systems and carrier-based pulse width modulation techniques. Further attention is paid to degrees of freedom of multiphase systems and their application, generation of modulation signals based on optimization criterion, minimization of Euclidean and infinite norms.

KEV/XVPM Power electronic converters
doc. Ing. Pavel Drábek, Ph.D.

The course is focused on deepening knowledge about power electronic converters designed for industrial and traction drives. Attention is focused on modern types of converters: Voltage and current active rectifiers, Multi-

quadrant and multiphase connections of DC/DC converters, voltage and current inverters with PWM modulation, direct and indirect frequency converters, AC voltage converters. The study is based on basic university professional literature and is supplemented by the study of actual works published in professional journals, proceedings and books.

KEV/XVPS Power semiconductor devices
doc. Ing. Pavel Drábek, Ph.D.

The subject deals with special semiconductor devices in power converters. For example modern devices based on Silicon Carbide can be mentioned (Schottky diodes, JFET, VJFET, MOSFET etc.) and their application in the power electronics – converters for high voltage application (e.g. multi level converters – NPC, M2LC) and current-source converters (current source active rectifiers, matrix converters etc.).

KEV/XVTDS Power Electronics Technology for Distribution Grids
doc. Ing. Tomáš Komrska, Ph.D.

The course objectives are active filters, reactive power compensation and earth fault compensation in distribution networks with isolated and inefficiently grounded neutral using active systems based on power semiconductor converters. Main attention is paid to compensation of single-phase ground faults by active current sources, i.e. systems with power converters connected to phase conductors and to neutral of the transformer, mathematical modeling, comparison with traditional resonant passive compensation methods (arc suppression coils), identification of faulty feeder, positive and zero-sequence component, determining the size of the required compensating current.

DEPARTMENT OF PHYSICS

KFY/XFYE Physics for electrical engineering PhD students
doc. Mgr. Šimon Kos, Ph.D.

Physical basis of phenomena studied and used by the electrical engineering PhD students adjusted to their specialization. Examples of the areas covered are: subatomic physics for electronic particle detectors (quantum mechanics, atomic structure, nuclear structure, radioactivity, elementary particles and their interactions), magnetism (quantum mechanics, magnetic properties of materials, atomic magnetism, susceptibilities, magnetism models), thermodynamics (state variables, thermodynamic ensembles, thermodynamic potentials, statistical distributions, phase diagrams, chemical equilibrium, fluctuations, kinetics), semiconductors (band structure, vibrations, doping, transport, optical properties)

DEPARTMENT OF INFORMATICS AND COMPURER SCIENCE

KIV/XMPSM Modern programming styles and methods
doc. Ing. Pavel Herout, Ph.D.

The aim of the course is to gain an overview of state of the art in the field and to learn the advanced principles used in the design of large software applications with regard to increased robustness and reliability. The content is: Object-oriented analysis, design and implementation of large-scale software applications. Testing. Theory and practice of markup languages. Scripting languages. Embedded application programming.

KIV/XZSS Software systems reliability
doc. Ing. Přemysl Brada, MSc., Ph.D.

The course aims to strengthen the knowledge in the area of software safety and gain an overview of current state of the art in related research. Topics include: Concepts, elements and properties of software architectures, their modeling, use of models in the implementation and verification of software-intensive systems, their relation to software quality attributes. Models and methods of computer and software system reliability, performance and safety, improving robustness of software-intensive systems, processes and techniques of safety-related software devlopment, principles and methods of testing.

DEPARTMENT OF CYBERNETICS

KKY/XTR Control Theory
prof. Ing. Miloš Schlegel, CSc.

The course contains basic tasks of contemporary linear control theory and methods of their solution. First, attention is paid to the relevant mathematical tools. Then there is an overview of classical, analytical and optimization methods in time and frequency domain. Linear multidimensional control systems are studied (order reduction, assignment of spectral properties by state, output and dynamic feedback, LQR, H2 and Hinfinity, sliding mode control). Further attention is paid to design of controllers with limited structure (fixed order controllers) and practical aspects of their design and implementation. The main emphasis is placed on the robustness of the proposed control systems.

DEPARTMENT OF MATHEMATICS

KMA/XMAP Applied Mathematics Methods
doc. Ing. Marek Brandner, Ph.D.

The aim is to acquaint doctoral students with the use of modern mathematical methods in electrical engineering. The theoretical foundations of these methods are discussed and specific application problems are solved. The course is two-semester. Content of the winter semester: ordinary differential equations, approximation of functions, numerical methods for solving initial and boundary value problems for ordinary differential equations. Content of the summer semester: analytical and numerical methods for solving partial differential equations, finite difference, finite volume and finite element methods.

KMA/XNMA Numerical methods and applications
doc. Ing. Josef Daněk, Ph.D.

The course is focused at parts of numerical mathematics.Topics of this course include:direct and iterative methods for linear systems with aplications for solution of partial differential equations, methods of matrix decomposition, conjugate gradient method, preconditioning, approximation of functions, finite elements method, multigrid and domain decomposition methods.

KMA/XPAS Probability and statistics
RNDr. Blanka Šedivá, Ph.D.

Basic topics: Probability theory, Discrete Random Variables and Probability Distributions, Continuous Random Variables and Probability Distributions, Join Random Variables and Probability Distributions, Descriptive statistic, Random sample, Convergence concepts, Point estimation, Statistical Intervals Based on a Single Sample, Test of Hypotheses, Simple Linear regression and Correlation. Advance topics: The Analysis of Variance, Nonlinear Regression, Multiple Regression, Logistic regression, Goodness of Fits Tests , Categorical Data Analysis, Non parametric tests of hypothesis. Simulation of random variables. Statistical Software.

DEPARTMENT OF MECHANICS

KME/XVMD Computational methods for dynamics
prof. Dr. Ing. Jan Dupal

Mathematical modelling of the dynamic continuum problems. Approximate methods of discretization. Modal analysis. Response calculations of the continua represented by self-adjointed and non-adjointed operators and by matrices (after discretization). Discretization of the beams, rotating shaft, plate and shell by means of FEM and structure modelling consisting of mentioned continua. Stress and stability analysis of non-symetric rotors and spatial body-beam systems. Numerical methods of the direct equation of motion integration. Using MATLAB programming.

DEPARTMENT OF INDUSTRIAL ENGINEERING AND MANAGEMENT

KPV/DGS Digital Production System

prof. Ing. Josef Basl, CSc.

Changes of thinking and philosophies due to the globalization and digitalization (chains, clusters, market forcibility). Necessity of digitalization of designing, planning and production control (MPM). Influence of digitalization on production cycle and process (PLM, PDM). Role and possibilities of software products. Concepts of digital enterprises in the world.

KPV/DPRS Industry 4.0/Society 4.0

prof. Ing. Josef Basl, CSc.

The course focuses on the overall philosophy of Industry 4.0. It focuses on the description and ways of implementing Cyber-Physical Systems with respect to the human factor that is inherently connected with this issue. There are introduced IoT, PLM, VR, AR, and more. The subject also deals with the impact of implementation on the company.