VŠB – Technical University of Ostrava
Faculty of Safety Engineering

Study Programme

P3908 Fire Protection and Industrial Safety

Ostrava, December 2004

Approved by the Scientific Board of Faculty of Safety Engineering on December 1, 2004

Name of Study Programme:	**Fire Protection and Industrial Safety**
Study Programme Code:	**3908V**
Study Programme Type:	**doctoral**
Awarded Academic Degree:	**"Doktor" (i.e. Doctor), abbreviated as Ph.D.**
Study Programme Form:	**daily study and a combination of daily and distance studies**
Standard Length of Study:	**3 years**
Actual Length of Study:	**daily study – 3 years** **combined study - 3 to 5 years**
Maximum Length of Study:	**7 years from the commencement of study to the submission of a dissertation (including the length of study interruptions)**

Objective of Study:
The objective of study is to prepare Ph.D. students for independent creative research work in the field concerned. The study part is directed towards broadening and deepening the theoretical base and detailed familiarisation with the most significant knowledge of the given field. This part is followed with the writing of a dissertation showing the ability to obtain original research results and develop them further.

Characterisation of the Branch of Study and the Graduate Profile

The doctoral study in the branch of Fire Protection and Industrial Safety represents the highest level of university education in fire protection and safety. The study follows the master study programme in the branches of Fire Protection Engineering and Industrial Safety and of Safety Engineering and other branches including safety elements and is designed for extra gifted individuals concerned with research and development, including applied R&D. The study is based on the multidisciplinarity of this branch of science and its comprehensiveness, and thus it is simultaneously of the extending and deepening character making it possible not only to be acquainted in detail with scientific principles, methods and tools of the specific specialisation of a doctoral student, but also to understand relations in a wide context of the branch of science and relations to the other natural, technical and social sciences.

The branch of study prepares the professionals who are able in the area of industrial safety and fire protection to identify and asses the sources of hazards of fires, explosions, industrial accidents and natural disasters, to qualitatively and quantitatively analyse the levels of risks, to find, apply and evaluate the means of prevention and protection, to design and implement measures for the elimination of incident consequences, to know the theory of crisis management, emergency planning and risk management. In addition to the area of hazard of acute effects, graduates will also be able to solve problems of risks having chronic effects, e.g. in the area of working environment, and risks induced intentionally. The abilities gained help the graduates to participate in solving the most serious theoretical and practical problems in the field of fire protection, industrial safety, occupational health and safety and civil protection.

Graduates can acquire positions especially in research and development, education, in organisations providing expert services in the area of fire protection and industrial safety, can held management positions in the state administration, in testing and development laboratories and in managements of enterprises and organisations.

The Course of Study and Characterisation of Subjects of Study

The studies are subject to individual study plans of the Ph.D. students (ISP). The study part of the plan usually consists of five examinations in natural sciences and profiling subjects and in a foreign language according to the offer of the Department of Languages (English, German, Spanish, French and Russian). In the case of graduates of master study programmes but the programme 3908T Fire Protection and Industrial Safety, ISP covers usually two more profiling subjects – Fire Safety in Structures, Technological Process Safety. Minimally two subjects are selected from the subjects of theoretical and applied theoretical bases. The subjects include the theoretical fields of safety, properties of substances and materials with regard to fire and safety characteristics, crisis management, emergency prevention and preparedness, fire safety, tactics of incident handling and subjects enabling the integrated view of safety and its management. According to the theme of a dissertation, the study plan can also include other subjects leading to the extension and deepening of doctoral student's knowledge in the relevant field. This is usually a case of subjects of doctoral studies of the other faculties of VŠB – Technical University of Ostrava (henceforth referred to as TUO), in justified cases of other institutions of higher education. The individual study plan is supplemented by other doctoral student's duties related to a dissertation and especially by pedagogical activity (usually 4 lessons a week as a maximum), publishing activity and study visits to other workplaces and abroad, etc.

Individual study plans of doctoral students are comprised of the following groups of subjects of study:

- subjects of the theoretical base (the group consists of 3 subjects from the offer of the branch of study concerned and further subjects of doctoral study from the offer of departments of natural sciences at VŠB-TUO)
- subjects of the applied theoretical base (the offer includes 8 subjects from the offer of the branch of study concerned)
- subjects of the given branch of study (the group consists of 23 subjects from the offer of the branch of study concerned),
- the other subjects (subjects of doctoral study from the offer of faculties, or VŠB-TUO, foreign language).

Placing individual subjects from the offer of the branch of study concerned into some of the above-mentioned groups is given in the following overview:

Number	Subject	Group
1	Chemistry	T
2	Selected Chapters from Physics*)	T
3	Mathematical Methods in Safety Engineering*)	T
4	Toxicology	A
5	Mathematical Theory of Reliability	A
6	Heat and Mass Transfer in Fire Protection	A
7	Integrated Management Systems	A
8	Cyndinics (Hazard and Risk Science)	A
9	Hydromechanics	A
10	Physical Chemistry of Burning and Explosion	A
11	Thermomechanics	A
12	Heat Exchange in Fire Protection	B
13	Chemistry of Burning and Extinguishing	B

Number	Subject	Group
14	Technological Process Safety	B
15	Fire Safety of Structures and Technologies	B
16	Management of Fire and Explosion Risks	B
17	Technical Equipment of Fire Protection	B
18	Explosion Prevention of Technological Facilities	B
19	Fire-Safety Equipment	B
20	Foundation for Modelling in Fire Protection Engineering	B
21	Fire Dynamics	B
22	Tactics for Incident Handling	B
23	Fire-Technical Properties of Materials	B
24	Environmental Influence on Man and OSH	B
25	Influence of Crisis Situations on Man	B
26	Geoinformation Technologies and Safety	B
27	Civil Protection	B
28	Dangerous Substances and Preparations	B
29	CBRN Safety	B
30	Risk Analysis	B
31	Environmental Measurement and Monitoring	B
32	Crisis Management	B
33	Psychological Aspects of Safety	B
34	Natural Disasters and Their Handling	B

*) These subjects may be supplemented by other subjects of the theoretical base of relevant branches of sciences according to other doctoral curricula of physical and mathematical departments of VŠB-TUO

T subjects of the theoretical base
A subjects of the applied theoretical base
B subjects of the branch of study concerned

Supplement

Documentation of study subjects of the study programme of Fire Protection and Industrial Safety – offer of subjects for the branch of Fire Protection and Industrial Safety

Subjects of the theoretical base

Chemistry

Guaranteed by: Doc. Ing. Petr Pánek, CSc.
Department: 617

The course covers rules of general, inorganic and organic chemistry. It is a theoretical basis of other subjects explaining the rules of processes taking place during fires and fire-fighting operations. The course provides an overview of material properties being needful for the safe treatment, storage, transport and use of the substances.

Teachers:
Doc. Ing. Petr Pánek, CSc.

Selected Chapters from Physics

Guaranteed by: Doc. Ing. Jiří Švec, CSc.
Department: 516

Physical quantities being of importance from the point of view of fire protection and industrial safety, their relations and use in safety engineering. Energy, its forms of transformation, effects of physical influences on materials and man. Mechanics from the point of view of safety engineering. Physical properties of substances, states of matter and their changes. Electrical energy, radiation, heat and associated hazards. Matter-radiation interaction.

Teachers:
Doc. Ing. Jiří Švec, CSc.

Mathematical Methods in Safety Engineering

Guaranteed by: Doc. RNDr. Zdeněk Boháč, CSc.
Department: 714

Statistical hypothesis testing. Stochastic processes. Simulation methods. Statistical regulation of the process. Experiment design.

Teachers:
Doc. RNDr. Zdeněk Boháč, CSc.

Subjects of the applied theoretical base

Toxicology

Guaranteed by: Prof. RNDr. Pavel Danihelka, CSc.
Department: 040

Definition of toxicology, its division. Substances harmful to health and their effects. System

toxicity, carcinogenity, mutagenity, reproduction toxicity, teratogenity, causticity, pungency, allergization, endocrine disruptors. Paths of poison entry into an organism and the fate of the poison within the organism. Toxicokinetics. Dose-effect relation. Exposure tests. Toxicological risk calculation. ERA. Acute, subchronic and chronic toxicity. Toxicity testing and epidemiological studies. Toxicity limits, methods of their determination. Toxicological databases, their validity and availability. Toxicology of the occupational environment. Acute toxicology and toxicology of catastrophes.
Poison classification. Gaseous poisons. Inorganic poisons, organic poisons. Narcotics and psychotropic drugs.

Teachers:
Prof. RNDr. Pavel Danihelka, CSc.
RNDr. Břetislav Smysl, CSc.

Mathematical Theory of Reliability

Guaranteed by: Doc. Ing. Radim Briš, CSc.
Department: 457

Basic terms: time to failure, failure rate, backup. Probability distributions in the theory of reliability: exponential, Weibull, normal, logarithmic-normal, gamma. Reliability characteristic estimation for complete and non-complete random sampling: sampling designs, MLE and MM methods. Analysis and reliability of the system: Boolean algebra, coherent systems, coherent system reliability. Multistate systems: general Markov model, non-restorable parallel, serial systems, etc., comparison of various models. Restorable system readiness: application of Markov models to the determination of readiness, readiness in steady time. Analysis of the complex system by using the fault tree method (FTA - Fault Tree Analysis), definitions and symbols for FTA, structural functions and coherency, FT and the coherent structure, qualitative and quantitative analyses by using the analytic approach, restorable system unreadiness, fault tree modularization. Simulation approach for the FTA analysis: Monte Carlo simulation for restorable systems, variance decreasing methods. Software means for quantitative risk evaluation: examples of reliability characteristic calculations by means of advances software units (e.g. SIMTREE), presentation of the simulation approach by a program in MATLAB.

Teachers:
Doc. Ing. Radim Briš, CSc.

Heat and Mass Transfer in Fire Protection

Guaranteed by: Doc. Ing. Jana Dobrovská, CSc.
Department: 619

A brief characterisation and basic laws of transmission phenomena. Heat diffusion, conduction as transmission phenomena. A common form of the differential equation of heat conduction and diffusion, conditions for problem uniqueness and methods for equation solving. Analytical, numerical and analogue procedures for solving. Theory of similarity. Thermal and diffusion criteria of similarity, forms of criterial equations. Heat conduction. Stationary heat conduction and transmission through solids of simple geometric shapes, the importance and use for the purposes of fire protection. A procedure in the control heat calculations for recuperative heat exchangers. The importance of thermal insulation, procedure for thermal insulation designing. Properties of insulation materials, criteria for material selection assessment. Heat transmission by convection without any change in the state of a liquid. Hydrodynamic and thermokinetic equations. Heat convection at a change of

state on the solid surface. Bubble and film boiling, limiting flow density. Theory of film condensation, the influence of the presence of a non-condensing inert gas. Droplet condensation. Boiling, condensation in a volume, the importance for the purposes of fire protection. Radiation of solids. Heat transfer by radiation in a perfectly diathermic environment, a closed and a so-called open systems. System choice, the influence of reflection radiation. Radiation through an absorbing environment, gas radiation, flame radiation. Spacings, general theoretical analysis of the problem. Solving in the stationary temperature field, screening walls, reflecting and absorbing walls. The procedure of solving when the heat flux density is given. Non-stationary heat conduction. Analytical methods, the procedure for solving the best known one-dimensional problems. Solving one-dimensional and more-dimensional problems at marginal conditions describing as precisely as possible the heat effect on the surface of solids in fire. Diffusion. Molecular and convective diffusion. Stationary and non-stationary diffusion. Fick's 1st and 2nd laws. Diffusion-temperature dependence, activation energy. Parallel and series diffusion. Diffusion rate constant. Dependence of the diffusion rate on hydrodynamic (aerodynamic) regimes. Effective thickness of the diffusion layer. Diffusion followed by a chemical reaction. The role of diffusion in homogeneous and heterogeneous kinetics. The significance of diffusion processes in burning and extinguishing.

Teachers:
Doc. Ing. Jana Dobrovská, CSc.

Integrated Management Systems

Guaranteed by: Prof. Ing. Jaroslav Nenadál, CSc.
Department: 639

Management system development. Basic principles of management systems. Leadership – trends and procedures. Benchmarking and its role in management systems. Formulation of enterprise policy and strategy. Goals of organisations and their reassignment to units. Organisational structure creation. Role and procedures of planning in management systems. Methods of defining the requirements of interested parties. Human resource management – importance and procedures. Human knowledge development – knowledge management. Procedures and methods of product design and development. Procedures and methods of product implementation management. Process management – management systems as a set of processes. Importance of and approaches to quality management. Methods and instruments of quality management. Environmental management systems – importance and approaches. Systems of safety and health management – importance and approaches. Application of standards to management systems – standards ISO series 9000, 14000, OHSAS 18000 and others. Measurements in management systems – importance and procedures. Management system re-examination. Auditing – importance and procedures. Balanced Scorecard – principle and applications. Excellence in organizations – models and their applications. Management system maturity assessment – self-evaluation. Perpetual improvement – procedures and methods. Development trends in management systems.

Teachers:
Prof. Ing. Jaroslav Nenadál, CSc.

Cyndinics (Hazard and Risk Science)

Guaranteed by: Prof. RNDr. Pavel Danihelka, CSc.
Department: 040

Cyndinics as a branch of science. Basic concepts of safety and hazard, risk and their management, development in the meaning of these terms in time, social-cultural context. Emergency ethics and handling. Terms: hazard, safety, risk, threat, etc. from the gnoseological point of view. Cyndinics as a multidisciplinary science, various degrees and causes of safety complexity. Systematic and system approach to dealing with safety, general rules of instruments and methods of its study. System safety, man-machine relation, philosophy and psychology of safety management.

Teachers:
Prof. RNDr. Pavel Danihelka, CSc.

Hydromechanics

Guaranteed by: Doc. Ing. Milada Kozubková, CSc.
Department: 338

Theory of machines for liquid transport: hydrodynamic pumps, specific energy, efficiency, Euler equation, losses inside the pump, rating, suction lift, the pump when changing the number of revolutions, coaction of pumps, measurement of pumps, special pumps, gas-pressure pumps, mammoth pumps, flow pumps, their application in fire engineering, efficiency and characteristics. Pipes and piping systems, water and air pipes, friction and local losses, various formulas for the calculation of friction losses, branched and cyclic piping systems, algorithmisation of network calculations, branched systems and IMADOS program, cyclic systems and Hardy-Cross program. Water shock and non-stationary flowing, mathematical model, graphic and initial solutions. Discharging systems, theory of a centrifugal nozzle and its spraying ability. Foundations of the theory of fixed extinguishing systems (FESs), definition of the extinguishing process, the dependence of intensity on extinguishing time. Basic relations for the determination of parameters of systems extinguishing areas and volumes, water, foam and dust FESs, FESs with inert gases and their calculations, halon FESs and their calculations.

Teachers:
Doc. Ing. Milada Kozubková, CSc.
Ing. Sylva Drábková, Ph.D.

Physical Chemistry of Burning and Explosion

Guaranteed by: Doc. Ing. Jana Dobrovská, CSc.
Department: 619

Thermodynamic and kinetic characteristics of burning and explosion. Reaction, combustion and explosion heats, temperature dependence, maximum reaction temperature. Chemical and physical equilibrium states. Properties of flammable and explosive substances, their thermochemical characteristics. Oxygen and air for burning and explosion, oxygen number. Composition of products of combustion and explosion, thermal effects, pressure and temperature. Isobaric and isochoric explosion temperatures. Specific fire heat.
Burning and explosion reaction mechanisms. Theory of chain reactions. Thermal mechanism, adiabatic reaction kinetics. Pressure, concentration and temperature limits of explosion. Induction periods. Explosiveness suppression by inerting.

Flame. Physical characteristics. Diffusion, kinetic, laminar and turbulent flames, temperature distribution within the flame. Flame stability.
Burning of gaseous, liquid and solid substances. Dispersion system combustion.
Mechanism of explosive transformations, explosive burning, 2nd order explosion, detonation. A shock wave, occurrence, propagation. Hydrodynamic theory of detonation.
Physical-chemical principles of suppression. Heat and temperature regimes of a fire. Extinguishing agents and their physical-chemical properties and actions. Dilution, cooling, interruption, retardation. Properties of colloidal systems at burning and extinguishing.

Teachers:
Doc. Ing. Jana Dobrovská, CSc.
Prof. Ing. Ľudovít Dobrovský, CSc., Dr.h.c.

Thermomechanics

Guaranteed by: Prof. Ing. Pavel Kolat, DrSc.
Department: 361

Importance of the subject. Kinds of working substances, basic terms. Ideal gas: basic laws, equation of state. 1st law of thermodynamics. Reversible changes in the state of ideal gas. Direct and reverse thermal cycles. 2nd law of thermodynamics. Entropy. Reverse and non-reverse processes. Comparison cycles of combustion engines and turbines. Compressors. Real gas, simplified calculation. Gas mixtures, gas mixing. Vapour: basic terms, use of tables and diagrams. Changes in the state of vapour. Ideal vapour cycle. Cooling equipment. Mixtures of gases and vapours, moist air. Flow of air masses. Continuity equation and kinetic equation. Isoentropic and real outflows of gases and vapours. A nozzle and a diffuser. Kinds of heat exchange, basic terms and laws. Differential equation of heat conduction. Stationary heat conduction and transmission, an unlimited plane and cylindrical walls. Heat transfer at fluid flow. Theory of similarity, forms of criterial equations. Heat transmission at a condition change. Heat radiation. Perfectly black solids, grey solids. Heat transfer by radiation between surfaces separated by a diathermic environment. Heat calculations for recuperative heat exchangers. Thermal insulation purpose and design. Foundations for the calculation of non-stationary heat conduction. Fuel classification and composition. Fundamentals of thermochemistry. The mass balance at the combustion of solid, liquid and gas fuels. Adiabatic combustion temperature. Fundamentals of combustion kinetics.

Teachers:
Prof. Ing. Pavel Kolat, DrSc.

Subjects of the branch of study concerned

Chemistry of Burning and Extinguishing

Guaranteed by: Prof. Ing. Václav Roubíček, CSc.
Department: 617

The overview of characteristic properties of flammable matters, including the methods of their division. Theoretical rules of burning processes. Physical, chemical and toxic properties of substances formed in the processes of combustion and pyrolysis of flammable matters. The overview of properties of existing extinguishing agents and development trends. Classical extinguishing agents with emphasis put on those properties that may be utilised well in the

extinguishing process even in connection with modern, high-effective extinguishing agents. The goal of the course is to acquaint the doctoral student with the latest extinguishing media and to draw the doctoral student's attention to such kinds of extinguishing agents that act quickly, safely and very efficiently even in the areas having a high level of risk in the course of fire-fighting operations.

Teachers:
Prof. Ing. Václav Roubíček, CSc.
Doc. Ing. Petr Pánek, CSc.

Heat Exchange in Fire Protection

Guaranteed by: Prof. Ing. Pavel Kolat, DrSc.
Department: 361

On the basis of common knowledge of the branch of study, Fire Protection Engineering and Industrial Safety, to deepen the knowledge primarily in the area of heat transmission in fire protection in relation to fire safety. When assessing fire safety, to utilise engineering approaches to solving. It is a case of the theoretical coping with heat transmission, computer simulations of chosen processes, the observation of fire parameters and the determination of critical points of the space under assessment with fire measures and the determination of safe spacings from the point of view of safety in fire protection.

Teachers:
Prof. Ing. Pavel Kolat, DrSc.
Doc. Ing. Zdeněk Kadlec, Ph.D.

Technological Process Safety

Guaranteed by: Doc. Ing. Ivana Bartlová, CSc.
Department: 040

The analysis of causes and conditions of releases of substances, fires and explosions. Properties and technical-safety parameters of gases and vapours of flammable liquids and their applications in safety practice. Principles of safety in the storage, production and transport of flammable liquids. Hazard assessment and prevention with basic physical processes – heating, drying, rectification. Specific causes of failures of reactors on the basis of their classification, assessment of the chemism of technological processes from the point of view of safety and reliability. Analysis of specific exothermic and endothermic chemical processes (polymerisation, dehydrogenation). Methods for the identification of hazards (risk resources) of technological processes. Safety studies, the importance and the method of processing.

Teachers:
Doc. Ing. Ivana Bartlová, CSc.
Prof. RNDr. Pavel Danihelka, CSc.

Fire Safety of Structures and Technologies

Guaranteed by: Ing. Isabela Bradáčová, CSc.
Department: 030

The aim of fire safety in structures is to prevent casualties and personal health damage and property losses or damages. It is especially the case of forming conditions for safe evacuations from burning or fire-endangered structures, preventing the spread of fire inside as well as outside the structure and forming the conditions for effective operations of fire fighting

brigades. The structure must be dimensioned to fit expected fire effects. The core of development of the given field is the specification of expected fire effects and the determination of optimum fire fighting measures, which includes the prevention of fire production and development in its first stage, the determination of fire risk with a fully developed fire, the specification of the third stage of fire, the dimensioning of building members and construction systems to fit the presupposed temperature field of particular fire stages, the optimisation of fire-fighting measures and economic risks, spreading of combustion products in a structure, person's movements in the course of evacuation, conditions for fire spreading outside of a structure and elsewhere, fire-fighting routes and conditions for efficient fire-fighting operations.

Teachers:
Ing. Isabela Bradáčová, CSc.

Management of Fire and Explosion Risks

Guaranteed by: Prof. Ing. Karol Balog, Ph.D.
Department: 030

The goal of the course is to obtain the ability to cope with engineering tools for the assessment of fire and explosion hazards and risks primarily in industries, storage management and in hazardous material handling. Knowledge attained is applicable to a wide area of risk analysis and management.

Teachers:
Prof. Ing. Karol Balog, Ph.D.
Doc. Ing. Michail Šenovský, CSc.

Technical Equipment of Fire Protection

Guaranteed by: Doc. Ing. Jiří Lošák, CSc.
Department: 030

The course is concerned with equipment inserted between men and acting subjects to protect health, lives, the property of individual persons and of the others when dealing with emergencies. A piece of equipment (machine, mechanism, apparatus, tool, gear and outfit) as a sum of material means and the method of application.

Teachers:
Doc. Ing. Jiří Lošák, CSc.

Explosion Prevention of Technological Facilities

Guaranteed by: Doc. Ing. Jaroslav Damec, CSc.
Department: 040

The course is orientated towards gas-phase burning (flame ignition, spread), properties of flammable gases and vapours, hazardous properties of flammable dusts, hybrid mixtures. Explosion-hazardous environment specification, initiation sources, design of measures to prevent explosion occurrence and spread by means of the construction explosion prevention. Application of protective measures to production facilities and piping.

Teachers:
Doc. Ing. Jaroslav Damec, CSc.

Fire Safety Equipment

Guaranteed by: Doc. Dr. Ing. Aleš Dudáček
Department: 030

The course deals with principles of the early detection of fires and fire-hazardous situations and principles of the function of various fire detectors and the whole automatic detection systems (ADS). Problems of the determination of fire detection time are discussed. Special attention is paid to the problems of effective securing fire detection in various spaces by means of ADS and especially to cooperation of ADS and other pieces of fire safety equipment (FSE) and the inclusion of FSE into the fire safety of structures and technologies.

Teachers:
Doc. Dr. Ing. Aleš Dudáček

Foundation for Modelling in Fire Protection Engineering

Guaranteed by: Prof. Ing. Karol Balog, Ph.D.
Department: 030

The goal of the course is to learn how to use the knowledge of fire engineering for the forecasting of fire development in confined spaces and how to do the calculations of amounts of heat and smoke released in the course of burning on the basis of mathematical modelling the process of heat generation and flame spread.

Teachers:
Prof. Ing. Karol Balog, Ph.D.
Doc. Dr. Ing. Aleš Dudáček

Fire Dynamics

Guaranteed by: Doc. Dr. Ing. Miloš Kvarčák
Department: 030

Conditions of fire origin and development, burning interruption and characterisation of other associated phenomena accompanying the fire in open space and in compartments. Fire parameters and their changes in the course of fire development. Fire temperature and the rate of burning, their influence on fire development. Analysis of the conditions of origin of Flashover, Rolleover, Backdraft. Characteristic of the course of fire before flashover origin and after flashover origin. Characteristic of liquid burning in containers and analysis of the conditions of Slopover, Frontover, Boilover origin. Characteristic of liquid burning on a surface and analysis of the conditions of Poolfire origin. Characteristic of liquid burning after liquid leak from a confined space and analysis of the conditions of Jetfire origin. Flame, its characteristic and parameters during fires in compartments and open burning of materials. Heat conduction, convection and radiation under fire conditions. Release of smoke by burning substances and smoke movement in structures. Natural and forced ventilation in structures under fire.

Teachers:
Doc. Dr. Ing. Miloš Kvarčák
Prof. Ing. Karol Balog, Ph.D.

Tactics for Incident Handling

Guaranteed by: Doc. Dr. Ing. Miloš Kvarčák
Department: 030

The basis of the course is the application of engineering knowledge related to the problems of fire fighting and large-scale accident handling at the presence of dangerous substances. Furthermore, the course is focused on the application of knowledge obtained from the area of fire dynamics, modelling the fire spread in structures and in the open area, including the spread of dangerous substances in space.

Teachers:
Doc. Dr. Ing. Miloš Kvarčák
Doc. Dr. Ing. Michail Šenovský

Fire-Technical Properties of Materials

Guaranteed by: Doc. Ing. Miroslava Netopilová, CSc.
Department: 030

The course deals with changes in properties of solid materials in connection with expected consequences of a fire in its development stages and the interpretation of these changed properties in relation to fire resistance of constructions and fire safety. In connection with a possibility of partial decreasing a fire hazard, systems of fire suppression treatment of materials and constructions together with possibilities of verifying their effectiveness and some properties are included as well. Knowledge of testing in the given area and the implementation of European standards for testing into fire-technical testing in the Czech Republic, including relevant relations is provided too.

Teachers:
Doc. Ing. Miroslava Netopilová, CSc.
Ing. Bohdan Filipi, Ph.D.

Environmental Influence on Man and OSH

Guaranteed by: Prof. Ing. Pavel Prokop, CSc.
Department: 542

The course includes basic causes and sources of occupational health damage, characterises working conditions and load, presents basic factors affecting the level of occupational safety and health (OSH), a set of safety and hygienic risks, the influence of human factor on OSH, influences of the working environment and also non-work influences and presents a set of basic legal regulations, decrees and orders related to OSH. It emphasises the influence of physical influences (light, heat and cold, ionizing and non-ionizing radiation, noise and vibration), working positions, effects of chemical substances, stress, social and psychological influences. It deals with environmental influences as a special category.

Teachers:
Prof. Ing. Pavel Prokop, CSc.

Influence of Crisis Situations on Man

Guaranteed by: Prof. PhDr. Hana Vykopalová, CSc.
Department: 040

The course deals with traumatic and loading situations and their effects on man, including many risk factors affecting behaviour, reacting and overall performance under loading

conditions, i.e. also the acting of other additional influences on human organism and health, the ability to make fast and adequate decisions and situation assessments and the analysis of all surrounding social-psychological influences and manifestations (aggression, anxiety, fear, stress, PTSP, individual behaviour, group behaviour and crowd behaviour). Crisis communication and the evaluation of its consequences also f form a part of the behaviour and influencing of all social systems.

Teachers:
Prof. PhDr. Hana Vykopalová, CSc.

Geoinformation Technologies and Safety

Guaranteed by: Doc. Ing. Petr Rapant, CSc.
Department: 548

Geodata, geoinformation, geoinformatics, geoinformation technologies, mobile geoinformation technologies. Positioning in space and time. Spatial modelling. GIS application structure. Geodata acquisition, analysis, visualisation. An overview of geoinformation technologies (GPS, GIS, DMR, digital photogrammetry, remote sensing). Safety of geoinformation technologies and methods of its ensuring. Information technology applications to the area of safety.

Teachers:
Doc. Ing. Petr Rapant, CSc.

Civil Protection

Guaranteed by: Doc. RNDr. Petr Linhart, CSc., IOOb Lázně Bohdaneč
Department: 030

History of civil protection in the Czech Republic, the position and role of civil protection in the existing safety environment. Civil protection in the EU and NATO countries, Civil Emergency Planning. Civil protection regulations, international humanitarian law. A set of activities and procedures leading to the minimisation of negative impacts of potential incidents and crisis situations on human health and life and living conditions. Mechanism of warning, evacuation, sheltering and emergency survival of people. Civil protection in emergency and crisis plans.

Teachers:
Doc. RNDr. Petr Linhart, CSc.

Dangerous Substances and Preparations

Guaranteed by: Doc. Ing. Ivana Bartlová, CSc.
Department: 040

Dangerous properties of chemical substances and preparations (except toxic). Flammability, explosiveness, oxidation abilities, radioactivity, biological risks (including GMO). Incompatibility of chemical substances, “runoff” reactions. Methods of testing dangerous properties, their strong and weak points. Labelling of dangerous substances in the context of the Czech Republic, Europe and the world. Legislation in the Czech Republic, Europe and the world. Management of dangerous substances in enterprises and during transport.

Teachers:
Doc. Ing. Ivana Bartlová, CSc.

CBRN Safety

Guaranteed by: Doc. Dr. Ing. Aleš Dudáček
Department: 030

CBRN substances, their classification, properties and effects. Variants of CBRN substance abuse, possibility of CBRN substance detection and identification. Safe zone, safe structure, safe building. Primary, secondary and tertiary prevention. Key significance of functions of ventilation and air-conditioning systems in secondary prevention. Use of technologies of intelligent buildings in primary and secondary prevention.

Teachers:
Doc. Dr. Ing. Aleš Dudáček
Doc. RNDr. Petr Linhart, CSc., IOOb Lázně Bohdaneč

Risk Analysis

Guaranteed by: Prof. RNDr. Pavel Danihelka, CSc.
Department: 040

Risks as a phenomenon and general problem of risk analyses. Common methodologies for risk analysis. Deterministic and probabilistic approaches to risk analysis. Process of risk analysis – source identification, risk assessment, risk management. Instruments for risk analysis – checklists, indexed methods, comprehensive methods. An overview and applications of methods Dow F+EI, Dow CEI, FTA, ETA, HAZOP, CPQRA, MOSAR. Principle of barriers and its utilisation. Chronic risk analysis, ERA.

Teachers:
Prof. RNDr. Pavel Danihelka, CSc.
Doc. Ing. Ivana Bartlová, CSc.
Dr. Ing. Aleš Bernatík

Environmental Measurement and Monitoring

Guaranteed by: RNDr. Michal Střižík, CSc.
Department: 040

General principles of physical measurements and chemical analyses. Signal origin, transmission and processing. Evaluation and interpretation of measured data, metrology. Chemical sensors. Measurement of physical quantities. Application in the area of safety engineering. Analysis of the atmosphere, soil and water contamination, the use of analytical techniques in investigation, monitoring and sensors for the detection and control of dangerous conditions. Continuous measuring and monitoring.

Teachers:
RNDr. Michal Střižík, Ph.D.

Crisis Management

Guaranteed by: Doc. Dr. Ing. Michail Šenovský
Department: 030

Crisis management is a form of management in incident handling, when non-standard methods are employed, and in declared states of emergency, when related legislation is also applied. It is concentrated on man, the natural and the artificial environment and on aspects connected with elements, relations and flows in a system created like that. Its aim is to ensure the sustainable development of human society, including basic functions of the state and the

administration in crisis situations. This is a matter of state administration and self-administration on all levels, private companies, governmental and humanitarian organisations and also of all citizens. It is a case of the process the goal of which is to keep the behaviour of the system within acceptable limits, within which desirable goals are realized and undesirable manifestations are suppressed.
The study of crisis management consists of diagnosing possible emergency situations, planning preventive measures and measures to mitigate incidents, ensuring preparedness to the handling of mentioned events, ensuring response to them, the initial state for the restoration of affected areas and triggering their next development. It uses the following tools: risk analysis and management, management, emergency, crisis and civil emergency planning. Moreover, the area of crisis economics and logistics is fundamental.

Teachers:
Doc. Dr. Ing. Michail Šenovský

Psychological Aspects of Safety

Guaranteed by: Prof. PhDr. Hana Vykopalová, CSc.
Department: 040

Catastrophes, technological defects, threats induced by industrial, natural, social and human factor failures. Manifestations and effects of load and stress (psychic and physiological), personality potential and individual perception of load and stress, causes, symptoms and development. Perception of working conditions and load in critical situations. Specific situations of emergency and solutions to them. Posttraumatic stress disorder and basic principles of psychohygiene, psychosocial programmes.

Teachers:
Prof. PhDr. Hana Vykopalová, CSc.

Natural Disasters and Their Handling

Guaranteed by: Prof. Ing. Pavel Poledňák, CSc., FŠI Žilinské univerzity v Žilině
Department: 030

History of natural disasters, case studies. Earthquakes, landslides, solifluction. Extreme meteorological phenomena, floods and inundations (including extraordinary). Winter climatic conditions - ice floods, snowfall, avalanches, frost, glaze. Forest and natural fires. Climatic changes and crises induced by them. Interaction between natural and technological disasters. Natural disaster prevention, mitigation of consequences and coping with natural crises. Logistics in emergency situations and the restoration of functions of the area affected.

Teachers:
Prof. Ing. Pavel Poledňák, CSc., FŠI Žilinské univerzity v Žilině