

PŘÍLOHA P1 k závěrečné zprávě o řešení rozvojového projektu: Internacionalizace studijních programů VŠCHT Praha

Internacionalizované bakalářské studijní programy Fakulty chemické technologie

Na Fakultě chemické technologie VŠCHT Praha byly v roce 2005 vytvořeny tři bakalářské studijní programy pro výuku v anglickém jazyce. Protože práce na přípravě těchto programů probíhaly mimo rámec tohoto projektu již v roce 2004, byly připravené programy dovedeny až do stadia akreditace.

Vytvořené studijní programy a studijní obory:

Study programme: **Applied Chemistry And Materials**
Study branch: **Chemistry And Chemical Technologies**

Study programme: **Applied Chemistry And Materials**
Study branch: **Chemistry And Technology Of Materials**

Study programme: **Applied Chemistry and Materials**
Study branch: **Informatics and Chemistry**

Charakteristiky, cíle studia, profily absolventů a studijní plány a sylaby předmětů zahrnutých ve studijních plánech jsou uvedeny dále.

Upřesnění cílů, podstaty a věcné náplně řešení projektu

Cíle:

1. Vypracovat bakalářské studijní programy, realizované v anglickém jazyce paralelně se studijními programy akreditovanými od akademického roku 2004/05 a vyučovanými v českém jazyce. Zpracovat podkladové materiály požadované k akreditaci, předložit bakalářské studijní programy v anglickém jazyce k akreditaci tak, aby jejich výuka byla zahájena od akademického roku 2005/06.

Plánované výsledky/výstupy:
Bakalářské studijní program (3)

2. Vypracovat magisterské studijní programy, realizované v anglickém jazyce paralelně se studijními programy akreditovanými od akademického roku 2004/05 a vyučovanými v českém jazyce tak, aby spolu s bakalářskými studijními programy tvořily ucelené strukturované studijní programy vyučované v anglickém jazyce. Zpracovat podkladové materiály požadované k akreditaci, předložit magisterské studijní programy v anglickém jazyce k akreditaci tak, aby jejich výuka byla zahájena nejpozději od akademického roku 2008/09.

Plánované výsledky/výstupy
v roce 2005: zahájení přípravy písemné dokumentace
v roce 2006: zpracování podkladů pro akreditaci

3. Vypracovat modifikované strukturované studijní programy, tj. programy zahrnující bakalářský i navazující magisterský stupeň, se zařazením bloku (volitelných) předmětů zaměřených na rozšíření znalostí absolventů a jejich schopností zapojit se do zavádění a následně kontroly nové chemické politiky Evropské unie, založené na tvorbě nového hodnocení a registrace chemikálií v Evropě. Tento blok bude obsahovat i předměty zaměřené na legislativní a správní aspekty EU včetně ekologických aspektů životního prostředí. Blok těchto předmětů představuje v chemicko-inženýrském vzdělání důležitou součást pro naše i zahraniční studenty, kteří budou hledat uplatnění v průmyslové praxi nebo v oblasti legislativně-správních činností, zejména ve vazbě k Evropské unii nebo přímé uplatnění v zahraničí především v rámci Evropské unie. Záměrem je rovněž zvyšovat počet zahraničních studentů rozšířením profilu absolventa a možnostmi jeho uplatnění. Zpracovat podkladové materiály požadované k akreditaci. Předložit studijní programy v anglickém jazyce k akreditaci tak, aby jejich výuka byla zahájena nejpozději od akademického roku 2008/09.

Plánované výsledky/výstupy v roce 2005:
zahájení výběru předmětů a přípravy nových předmětů k vytvoření bloku předmětů tvořících modulovou výuku absolventů daného profilu

Stav splnění výstupů plánovaných pro rok 2005:

Ad 1) v anglickém jazyce připraveny charakterizace 3 studijních oborů (Chemie a chemické technologie – Chemistry and Chemical Technologies; Chemie a technologie materiálů – Chemistry and Technology of Materials; Informatika a chemie – Informatics and Chemistry) studijního programu Aplikovaná chemie a materiály – Applied Chemistry and Materials;

Sylaby předmětů, proveden výběr vyučujících jednotlivých předmětů s garancí vedoucích ústavů, zmapována připravenost vyučujících vést výuku v anglickém jazyce, připraveno zajištění učebních pomůcek v anglickém jazyce v nezbytném základu pro zahájení výuky, zajištění zkoušek a státních závěrečných zkoušek, vypracovány učební plány, přijímání ke studiu – formuláře.

V červenci 2005 podána žádost o akreditaci 3 bakalářských studijních oborů studijního programu Aplikovaná chemie a materiály (Applied Chemistry and Materials). Akreditace proběhla září 2005 (viz. Příloha). Zveřejněno otevření bakalářských studijních programů. Cíle pro rok 2005 splněny v plném rozsahu. V roce 2006 bude realizováno postupné doplňování a rozšiřování spektra učebních pomůcek.

Ad 2) zahájena příprava:

- písemné dokumentace magisterských studijních programů v anglickém jazyce,
- personálního obsazení vyučujícími včetně přehledu o jejich jazykové připravenosti
- nezbytného základu učebních pomůcek.

Cíle pro rok 2005 splněny. V roce 2006 budou ukončeny podklady magisterských studijních programů v anglickém jazyce pro akreditaci.

Ad 3) Proveden základní výběr předmětů a příprava nových předmětů k sestavení bloku předmětů tvořících modulovou výuku absolventů se schopnostmi orientovat se v oblasti legislativy vztahující se k problematice chemie a ochrany životního prostředí ve vztahu k EU, s prohloubenými schopnostmi samostatné prezentace výsledků práce a odborně připravených na činnost v oblasti kontroly chemických výrob, chemických výrobků a znečištění životního prostředí. Výběr předmětů a příprava nových předmětů byly provedeny i s ohledem na předpokládané uplatnění absolventů zejména v legislativně správních orgánech ČR a EU, kontrolních laboratořích, podnikové kontrole, odborech životního prostředí ve státní správě, inspekci životního prostředí, hygienické službě, hasičském sboru, atd.

Faculty of Chemical Technology

STUDY PROGRAMME: Applied Chemistry and Materials

Field of study: Chemistry and Chemical Technologies

Characteristics:

The study prepares experts with a broad engineering and chemical education for work in various fields of research, manufacture, application, and in the field of commerce. In addition to fundamental chemical-technological education, students may choose special subjects according to their specialization. They gain practical knowledge of basic inorganic and organic technologies including catalyzed processes. They get acquainted with the synthesis and manufacture of chemical specialties (organic chemicals and pharmaceuticals, tenzides, colorants, fragrances). Students learn to apply advanced analytical methods in raw materials input control, inter-operational control, and in product quality analysis. They get to know analytics applied in monitoring environmental pollution. They acquire practical skills in using computers for technical and administrative purposes, and they learn advanced methods of production management. If they wish, they may also substantially expand their knowledge of foreign languages.

Graduate profile:

The broad choice of subjects offered within the study programme allows graduates to start their careers or to continue their studies in related engineering (equal to MSc) study programmes. Graduates may work in research, in manufacturing companies or in small chemical plants. They may also find jobs in consulting agencies, designing companies, commercial-technical organizations, and in home and foreign trade companies. Given their technology-oriented synthetic way of thinking acquired during studies, graduates may also work in other engineering fields after some training.

Study Year: 1

Winter Semester

<i>Code</i>	<i>Required Subjects</i>	<i>Dep.</i>	<i>L</i>	<i>S</i>	<i>Lab</i>	<i>Assessment</i>	<i>Credits</i>
Required Subjects							
N101005	General and Inorganic Chemistry I	101	3	2	0	c,Ex	8
N413002	Mathematics I	413	3	3	0	c,Ex	9
N111009	Toxicology and Ecology	111	2	0	0	Ex	3
N445001	Applications of Computer Science	445	0	3	0	c	3
N101002	Chemical Calculations	101	0	2	0	c	2
N437005	Enterprise Economics	437	2	1	0	c,Ex	4
N963006	Introduction to Studies	963	1	0	0	c	1
N827001	Physical Education	827	0	2	0	c	0

Summer Semester

<i>Code</i>	<i>Required Subjects</i>	<i>Dep.</i>	<i>L</i>	<i>S</i>	<i>Lab</i>	<i>Assessment</i>	<i>Credits</i>
Required Subjects							
N110004	Organic Chemistry I	110	3	2	0	c,Ex	7
N444001	Physics I	444	3	2	0	c,Ex	7
N101003	Inorganic Chemistry: Laboratory I	101	0	0	4	c	3
N437003	Management of Enterprise Processes	437	2	1	0	c,Ex	4
N834001	Language I	834	0	2	0	c	0
N827002	Physical Education	827	0	2	0	c	0
Semi-elective Subjects 1 and 2							
N413003	Mathematics II	413	3	3	0	c,Ex	8
N101006	General and Inorganic Chemistry II	101	2	2	0	c,Ex	5
N832013	Law Basics	832	2	0	0	Ex	3
N832011	Human Resources Management	832	2	1	0	c,Ex	4
Recommend Subject							
N444002	Fundamentals of Physics: Repetition	444	0	2	0		0
Elective Subjects							
	Elective Subjects for the 2nd Semester						

Study Year: 2

Winter Semester

<i>Code</i>	<i>Required Subjects</i>	<i>Dep.</i>	<i>L</i>	<i>S</i>	<i>Lab</i>	<i>Assessment</i>	<i>Credits</i>
Required Subjects							
N403011	Physical Chemistry I	403	3	2	0	c,Ex	7
N320001	Biochemistry I	320	3	0	0	Ex	5
N110002	Organic Chemistry: Laboratory I	110	0	0	4	c	3
N444003	Physics: Laboratory	444	0	0	3	c	2
N111003	Chemical Informatics	111	0	2	0	c	2
N105004	Fundamentals of Chemical Technologies	105	2	0	0	Ex	3
N108004	Introduction to Study of Materials	108	2	0	0	Ex	3
N834002	Language II	834	0	2	0	c,Ex	0
N827003	Physical Education	827	0	2	0	c	0
Semi-elective Subject 3							
N110005	Organic Chemistry II	110	2	1	0	c,Ex	4
N444006	Physics II	444	2	2	0	c,Ex	5
N437022	Fundamentals of Marketing Chemical Products	437	2	0	0	Ex	3
N111008	User Software	111	0	3	0	c	3
N101004	Inorganic Chemistry: Laboratory II	101	0	0	4	c	3
Elective Subjects							
	Elective Subject for 3rd Semester						

Summer Semester

<i>Code</i>	<i>Required Subjects</i>	<i>Dep.</i>	<i>L</i>	<i>S</i>	<i>Lab</i>	<i>Assessment</i>	<i>Credits</i>
Required Subjects							
N409002	Chemical Engineering I	409	2	3	0	c,Ex	6
N402002	Analytical Chemistry I	402	2	1	0	c,Ex	4
N413004	Applied Statistics	413	1	2	0	c,Ex	4
N403013	Physical Chemistry: Laboratory I	403	0	0	4	c	3
N827004	Physical Education	827	0	2	0	c	0
Semi-elective Subjects 4 and 5							
N403014	Physical Chemistry II	403	3	2	0	c,Ex	7
N110003	Organic Chemistry Laboratory II	110	0	0	4	c	3
N107004	Characterization Methods for Substances	107	2	2	0	c,Ex	5

N111006	Environmental Protection Processes	111	2	1	0	c,Ex	4
N112003	Macromolecular Chemistry	112	2	1	0	c,Ex	4
N111002	Chemical Database Systems	111	0	2	0	c	2
Elective Subjects							
	Elective Subject for 4th Semester						

Study Year: 3

Winter Semester

<i>Code</i>	<i>Required Subjects</i>	<i>Dep.</i>	<i>L</i>	<i>S</i>	<i>Lab</i>	<i>Assessment</i>	<i>Credits</i>
Required Subjects							
N409013	Chemical Engineering: Laboratory	409	0	0	3	c	2
N402503	Analytical Chemistry: Laboratory I	402	0	0	6	c	4
N409004	Chemical Engineering: Project	409	0	1	0	c	1
N111010	Data Acquisition and Data Treatment	111	1	2	0	c,Ex	4
N150013	Specialized Laboratory	150	0	0	6	c	4
Programm Semi-elective Subjects 1							
N111007	Raw Materials in Chemical Industry	111	2	1	0	c,Ex	4
N111005	Catalysis	111	2	1	0	c,Ex	4
N106003	Materials Corrosion	106	2	1	0	c,Ex	4
Semi-elective Subjects 6 and 7							
N409003	Chemical Engineering II	409	2	3	0	c,Ex	6
N402004	Analytical Chemistry II	402	2	1	0	c,Ex	4
N403012	Physical Chemistry: Laboratory II	403	0	0	3	c	2
N110001	Pharmacochemistry	110	2	0	0	Ex	3
N105005	Fundamentals of Computer Simulation	105	2	2	0	c,Ex	5
N101001	Safety Legislation in Chemistry	101	2	0	0	Ex	3
Elective Subjects							
	Elective Subject for 5th Semester						

Summer Semester

<i>Code</i>	<i>Required Subjects</i>	<i>Dep.</i>	<i>L</i>	<i>S</i>	<i>Lab</i>	<i>Assessment</i>	<i>Credits</i>
Required Subjects							
N963007	Bachelor work	963	0	0	8	SFE	10
Semi-elective Subjects 8							
N402007	Analytical Chemistry: Laboratory II	402	0	0	4	c	3
N110006	Structural Analysis	110	2	1	0	c,Ex	4
N111011	Fine Chemicals	111	2	1	0	c,Ex	4
N111001	Safety in Chemical Production	111	2	1	0	c,Ex	4
N105001	Applied Chemical Processes	105	2	1	0	c,Ex	4
Elective Subjects							
	Elective Subject for 6th Semester						

Subject Title: General and Inorganic Chemistry I

Semester: 1st

Weekly Load and Assessment: 3/2/0 c, Ex

Credit: 8

Language: English

Course provider: Department of Inorganic Chemistry

Annotation:

1. Structure of atom, atomic orbitals and their occupation. Configuration of valence sphere.
2. Periodic law. Classification of elements. Vertical and horizontal similarities.
3. Chemical bond. Covalent and ionic bond, electronegativity, polarization force.
4. Stoichiometry of compounds of nontransition elements. Structural formulas and their utilization.
5. Hybridization of AO. Structure and properties of molecules nontransition elements.
6. Hydrogen, oxygen, bonding possibilities. Water, aqueous solutions, acids and bases.
7. Halogens, rare gases, bonding possibilities. Compounds of halogens, redox reactions.
8. Sulfur, bonding possibilities, important compounds. Factors influencing reaction path.
9. Nitrogen, bonding possibilities. Chemical equilibrium and kinetics. Compounds of nitrogen.
10. Phosphor. Compounds of phosphor, polyanions. The most important inorganic compounds.
11. Carbon, silicon and their compounds, bonding possibilities of elements of the 2-nd and higher periods.
12. Production of important metals, metal bond and properties of metals, metal corrosion.
13. Nontransition metals, bonding possibilities, group trends, diagonal relationship.
14. Transition metals, bonding possibilities, trends in groups and periods.

Subject Title: Mathematics I

Semester: 1st

Weekly Load and Assessment: 3/3 /0 c, Ex

Credit: 9

Language: English

Course provider: Department of Mathematics

Annotation:

1. Elements of Mathematical Logic. Introduction to calculus.
2. Continuity and limits of the functions of one and two variables.
3. Derivatives, Mean value theorem, L' Hospital's rule. Partial derivatives.
4. Monotone functions, extreme values of a function, asymptotes of the graph.
5. Newton's methods. Taylor's formula with remainder. Differential.
6. Curves in plane, tangent vector. Polar coordinates.
7. Indefinite integral. Definite integral. Applications in Geometry and Physics.
8. Techniques of integration.
9. Improper integrals. Numerical integration. The mean value theorem for integrals.
10. Ordinary differential equations of the first order. Separable equations.
11. Linear differential equations of the first order and their applications. Euler's method.
12. The space \mathbb{R}^n , geometry in \mathbb{R}^3 , vectors, dot and cross products.
13. Matrices and Determinants. Inverse matrix.
14. The systems of linear algebraic equations. Gauss-Jordan method. Cramer's rule.

Subject Title: Toxicology and Ecology

Semester: 1st

Weekly Load and Assessment: 2/0/0 Ex

Credit: 3

Language: English

Course provider: Department of Organic Technology

Annotation:

1. Toxicology, its scope and basic principles
2. Historical background of modern Toxicology
3. The most common inorganic, herbal, animal, microbiological and fungi poisons
4. Xenobiotics – classification
5. Xenobiotics and their interactions with a living body
6. Biochemical effects of xenobiotics
7. Modes of intercellular communications
8. Biotransformation processes
9. Most common organic poisons (e.g. drugs)
10. Materials Safety Data Sheets
11. Exposure limits and safety rules, law regulations
12. Ecotoxicology
13. Toxicology and chemical industry

Literature: Lecture notes, a special text is now being prepared

Subject Title: Application of Computer Science

Semester: 1st

Weekly Load and Assessment: 0/3/0 c

Credit: 3

Language: English

Course provider: Department of Computing and Control Engineering

Annotation:

1. Information technology, computer architecture, operational systems principles
2. Computer networks, Internet fundamentals, e-mail
3. Text editor fundamentals, basic functions, styles
4. Technical writing, formulas, equations and tables
5. Computer graphics fundamentals, formats, graphic object inserting
6. Spreadsheets, formulas and functions applications
7. Graphics in spreadsheets, worksheets, functions survey
8. Data transfer in spreadsheets and text editors, tables and graphs export
9. Technical applications of spreadsheets, data files processing
10. Database operations, data classification in spreadsheets, information filtering
11. File transfer, data import to spreadsheets, data export
12. Numeric and graphical processing of a real data in spreadsheets
13. Information systems integration, files administration
14. Student individual project using PC

Subject Title: Chemical Calculations

Semester: 1st

Weekly Load and Assessment: 0/2/0 c

Credit: 2

Language: English

Course provider: Department of Inorganic Chemistry

Annotation:

1. Basic physical properties and units. Composition of mixtures and compounds.
2. Preparation of solutions of pure and/or impure substances.
3. Preparation of solutions by dilution or by mixing of different solutions.
4. Stoichiometry calculations (including reactions of the ideal gas).
5. Stoichiometry calculations, reactions with an excess of reactants.
6. Preparation of solutions and stoichiometry calculations.
7. Saturated solutions, solution preparation by dissolving or concentrating.
8. Saturated solutions, disturbed crystallisation.
9. Recapitulation.
10. Test.
11. Recapitulation.
12. 1. Test reparation.
13. Recapitulation.
14. 2. Test reparation.

Subject Title: Enterprise Economics

Semester: 1st

Weekly Load and Assessment: 2/1/0 c, Ex

Credit: 4

Language: Czech, English

Course provider: Department of Economics and Management of Chemical and Food Industry, Ing. Milan R. Paták, CSc.

Annotation:

1. Enterprise as a economic subject, influence of state, tax system
2. Asset, Equity and Debt Classification
3. Structure of Assets, Evaluation of Assets, Depreciations, Turnover
4. Structure of Equity and Debts, Financial Resources
5. Cost and Revenues, Cash-Flow Statement
6. Classification of Costs, Break-Even Point
7. Enterprise - Subject of Market, Sales, Profit, Price
8. Cost and Output Costing, Costing Use, Division Costing
9. Non-absorption Costing, Specific Costing Algorithm in Chemical and Food Industry
10. Production process and its structure, type of production, relationship of production process at the time, material accuracy
11. Basic items of the production process, performance indicators, standards and their position, material and energy in the production process
12. Production equipment, extensive equipment utilization, maintenance systems, intensive equipment utilization, throughput capacity, performance diagram
13. Labour utilization in the production process, operating standards, productivity of labour
14. Feasibility studies, innovations

Literatures

Keat P.G., Young P.K.Y.: **Managerial Economics**, Upper Saddle River, New Jersey 2003, ISBN 0-13-035335-3

Mansfield E. et al: **Managerial Economics**, W.W.Norton&Company, New York 2002, ISBN 0-393-97677-7

Subject Title: Organic Chemistry I

Semester: 2nd

Weekly Load and Assessment: 3/2 /0 c, Ex

Credit: 7

Language: English

Course provider: Department of Organic Chemistry

Annotation:

1. Introduction, main groups of organic compounds. Oxidation state.
2. Nomenclature of organic compounds – functional groups.
3. Shape of organic compounds – introduction to stereochemistry.
4. Alkanes, radical substitution, structure of free radicals.
5. Alkenes, addition reactions, structure and stability of carbocations.
6. Dienes, pericyclic reactions, alkynes.
7. Arenes, regioselectivity of electrophilic substitution, oxidation and reduction.
8. Haloderivatives, organometallic compounds, S_N .
9. Hydroxyderivatives, eliminations and rearrangements.
10. Organic derivatives with S, N, P functional groups.
11. Aldehydes and ketones. A_N .
12. Aldehydes and ketones – enolates and their reactions.
13. Carboxylic acids – mechanism esterification.
14. Derivatives of carboxylic acids.

Subject title: Physics I

Semester: 2nd

Weekly Load and Assessment: 3/2 /0 c, Ex

Credit: 7

Language: English

Course provider: Department of Physics and Measurements

Annotation:

1. Basic concepts of mechanics I: Force, the Newton's laws, work, power, kinetic and potential energy. Conservation of mechanical energy and linear momentum, elastic and inelastic collisions.
2. Basic concepts of mechanics II: Moment of inertia, torque, angular momentum. Work, power and energy in rotational motion. Rolling motion of rigid bodies. Static equilibrium conditions, center of gravity.
3. Introduction to the kinetic theory of gases: Kinetic interpretation of pressure and temperature. Average kinetic energy of molecules. Velocity distribution of molecules. Mean free path of a molecule.
4. Continuum and fluid mechanics: Forces in continuum, deformation, Hooke's law. Hydrostatic pressure, Archimedes' law. Bernoulli's equation, real liquid flow.
5. Oscillations: undamped, damped and forced harmonic oscillations. Composed oscillations.
6. Waves: description, propagation velocity, intensity. Huygens principle, refraction and reflection, Snell law. Interference, standing waves.
7. Electrostatic field: Coulomb's law. Electric dipole. Potential, voltage, work. Capacitor, dielectric polarization. Charge motion in an electric field.
8. Direct current circuits: Ohm's law, Joule law. Kirchhoff's rules. Current, voltage and resistance measurements.
9. Magnetic field: Magnetic force. Mass spectrograph, electric measurement instruments, cyclotron, the Hall effect. Biot-Savart law, Ampere's law. Magnetic fields in matter.
10. Electromagnetic field: electromagnetic induction, proper and mutual inductance. Electromagnetic waves, energy of electromagnetic field.
11. Alternating current circuits: Generator. Power. Impedance, phase shift, serial resonance circuit.
12. Wave optics: concept of light, interference, thin film, single-slit diffraction, diffraction grating, polarization, optical activity.
13. Geometric optics: Basic concepts, reflection and refraction, optical instruments: magnifying glass, microscope, telescope.
14. Basic concepts of modern physics: The photoelectric effect, X-rays, the particle-wave duality, absorption, emission, laser.

Subject Title: Inorganic Chemistry: Laboratory I

Semester: 2nd

Weekly Load and Assessment: 0/0/4 c

Credit: 3

Language: English

Course provider: Department of Inorganic Chemistry

Annotation:

1. Laboratory rules and safety, writing laboratory reports
2. Fundamental laboratory equipment
3. Basic laboratory works - dissolution, filtration, evaporation, precipitation, decantation
4. Fundamental laboratory operations - crystallization, weighing, density, pH
5. Oxidation - reduction reactions, procedure in solution and in solid state
6. Non-metal chemistry, reactions of non-metals and their compounds
7. Preparations of characteristic compounds of selected elements, mass balances
8. Important qualitative reactions of anions, determination of unknown samples
9. Metal chemistry - reaction of metals and their compounds
10. Preparations of characteristic metal compounds and their reaction
11. Coordination compounds of transition metals
12. Qualitative analysis of cations, separation and identification of unknown samples

Subject Title: Management of Enterprise Processes

Semester: 2nd

Weekly Load and Assessment: 2/1/0 c, Ex

Credit: 4

Language: Czech, English

Prerequisites: Enterprise Economics

Course provider: Hradecký

Annotation:

1. Corporate Management in Chemical and Food Industry
2. Decision-Making Information Support
3. Corporate Planning
4. Corporate Plans Structure
5. Marketing in Corporate Management
6. Distribution Management
7. Production Management
8. Purchase Management
9. Organization, Company Structure
10. Human Resources Management – Evaluation and Motivation
11. Time Management and Team Work
12. Safety and Quality Management
13. Environmental Management
14. Controlling and Auditing

Literature:

1. Samuelson W.F., Marks S.G. *Managerial Economics*. Lachina Publishing 2003. ISBN 0-470-00044-9.
2. Cole G.A. *Management, Theory and Practice*. DP Publications, Ltd. London 1990. ISBN 1 870941 90 X.
3. Weihrich H., Koontz H. *Management a Global Perspective*. Mc-Graw-Hill, Inc. 1993. ISBN 0-07-069170-3.

Subject Title: Mathematics II

Semester: 2nd

Weekly Load and Assessment: 3/3/0 c, Ex

Credit: 8

Language: Czech, English

Prerequisites: Mathematics I

Course provider: Department of Mathematics

Annotation:

1. Linear space, base, dimension. The space $C(I)$. Linear mapping.
2. Linear differential equations of n-th order.
3. The system two linear and nonlinear differential equations of the first order.
4. Predator-Prey models: Lotka-Wolterra System.
5. Geometry in \mathbb{R}^3 (\mathbb{R}^n). Metrics in \mathbb{R}^n .
6. Differential calculus in \mathbb{R}^n . The functions of two and more variables.
7. Directional and partial derivatives. Tangent plane. Gradient. Newton's method.
8. Taylor's formula. The Hessian and extreme values. Method of least squares.
9. Implicit function theory.
10. Line integral of scalar and vector field.
11. Differential form, exact differential form, Potential vector field.
12. Line integrals independent of the path.
13. Double integrals. Fubini theorem, Substitution in double integral. Improper integrals.
14. Triple integrals. Applications. Cylindrical and spherical coordinates.

Subject Title: General and Inorganic Chemistry II

Semester: 2nd

Weekly Load and Assessment: 2/2/0 c,Ex

Credit: 5

Language: English

Course provider: Department of Inorganic Chemistry

Annotation:

1. Atomic orbitals. 3d/4s problem. Molecular orbitals.
2. Periodic law. Vertical and horizontal similarities. p-,d-, a f- contraction.
3. Symmetry of molecules. Hybridization for lowered symmetry cases.
4. Hydrogen, hydrogen bonding, hydrides. Van der Waals interactions and noble gases.
5. Oxygen. Lewis theory of acids and bases. Oxide acidity. Ozone. Peroxides.
6. Halides. Stability of oxidation states. Redox potentials.
7. 16th group – from nonmetals to metals. Homo- and heterocatenating.
8. Nitrogen and phosphorus. Bonding characteristics of the 2nd and lower period elements.
9. Carbon, silicon, boron. Single, multiple and multicentered bonds.
10. Chemical bonding in solids and their properties. Metals, semiconductors, insulators.
11. Principles of crystal chemistry. Structure types.
12. Coordination compounds. Geometrical and optical isomerism. Symmetry.
13. Bonding and properties of coordination compounds. Organometallic compounds.
14. Influence of inert pair and lanthanide contraction on the chemical properties of metals.

Literature: G. E. Rogers, Descriptive Inorganic, Coordination, and Solid State Chemistry, 2nd Ed., Thomson Learning, 2002.

Subject Title: Law Basics

Semester: 2nd

Weekly Load and Assessment: 2/0/0 Ex

Credit: 3

Language: English

Course provider: Department of Social Sciences

Annotation:

1. Private law relations
2. Real rights
3. Law of obligations
4. Civil relations/ Civil law relations
5. Contracts according to Civil Code
6. Entities of business activity
7. Commercial obligations
8. Contracts according to Business Code
9. Housing law
10. Family law
11. Law of succession
12. Judicial proceedings
13. Labor law

Literature:

Civil Substantive Law, vol. I and II, 2nd edit. Codex, Praha 1997,
2nd edit. Codex Bohemie, Praha 1997

Subject Title: Human Resources Management

Semester: 2nd

Weekly Load and Assessment: 2/1 /0 c, Ex

Credit: 4

Language: English

Course provider: Department of

Annotation:

1. Fundamental Concepts of Human Ressource Management
2. Human Ressource Planning
3. Job Analysis and Job Design
4. Recruitment, Selection Process
5. Performance Appraisal and Feedback
6. Reward Systems
7. Work Motivation
8. Career Planning and Development
9. Organizational Culture
10. Internal and External Communication Process
11. Work Team
12. Work Stress
13. Approaches to Organization Change
14. Stimulating Organizational Creativity and Cooperative Behavior

Subject Title: Fundamentals of Physics: Repetition

Semester: 2nd

Weekly Load and Assessment: 0/2 /0

Credit: 0

Language: English

Course provider: Department of Physics and Measurements

Annotation:

1. Physical quantities, units, changing units
2. Vector calculus
3. Kinematics of motion along a straight line or a curve
4. Dynamics of motion along a straight line
5. Dynamics of motion along a curve
6. Work, power, efficiency, mechanical energy
7. Motion in a gravitational field
8. Rigid body statics
9. Rigid body motion
10. Archimedes' law, hydrostatic pressure
11. Ideal liquid flow
12. Basic problems of geometric optics
13. Basic problems of direct current circuits
14. Basic problems of alternating current circuits

Subject Title: Physical Chemistry I

Semester: 3rd

Weekly Load and Assessment: 3/2 /0 c, Ex

Credit: 7

Language: English

Course provider: Department of Physical Chemistry

Annotation:

1. Basic terminology, thermodynamic system, thermodynamic process, state properties.
2. State behaviour of gases, equation of state of ideal gas. Real gas and its behaviour.
3. 1st law of thermodynamics. Internal energy, heat, work.
4. Enthalpy, heat of reaction, standard enthalpy of formation. Hess and Kirchhoff's laws.
5. 2nd law of thermodynamics, entropy. Entropy changes on selected processes.
6. Helmholtz and Gibbs energy, their significance. 3rd law of thermodynamics.
7. Partial molar quantities, activity, chemical potential, standard states.
8. Material balance of chemical reactions. Equilibrium constant. Equilibria in electrolyte systems.
9. Chemical equilibria of reactions in gaseous phase.
10. Galvanic cells, symbols, usage, Nernst equation.
11. Basic terminology of chemical kinetics, reaction rate, integration of rate equations.
12. Phase equilibria in single-component systems, Clapeyron equation.
13. Gibbs phase law, vapour-liquid equilibrium in ideal systems, phase diagrams.
14. Solubility of gases in liquids, equilibria in condensed systems.

Reading

- Novák J. a kol.: Fyzikální chemie – bakalářský kurz , VŠCHT Praha 2005 (in Czech)
- Novák J. a kol.: Fyzikální chemie II , VŠCHT Praha 2001 (in Czech)
- Atkins P.W.: Physical Chemistry , Oxford University Press 1998 (in English)
- Malijevský a kol.: Physical Chemistry in Brief, VŠCHT Praha 2005, available in English on the Internet (Web pages of the Department of Physical Chemistry)

Subject Title: Biochemistry I

Semester: 3rd

Weekly Load and Assessment: 3/0 /0 Ex

Credit: 5

Language: English

Course provider: Department of Biochemistry and Microbiology

Annotation:

1. Living systems, their composition and organisation.
2. Aminoacids (properties, reactions, determination) and peptides.
3. Proteins (relation between structure and function).
4. Enzymes: structure, nomenclature, classification.
5. Reaction kinetics of enzyme reactions, regulation of enzyme actions.
6. Chemistry of nucleotides and nucleic acids, replication.
7. Transcription, translation, posttranslational modifications.
8. Chemistry of lipids. Biomembranes and membrane transport.
9. Principles of metabolism. Bioenergetics.
10. Aerobic and anaerobic respiration, light reactions of photosynthesis.
11. Citric acid cycle and glyoxylate cycle.
12. Chemistry of carbohydrates. Carbohydrate metabolism I.
13. Carbohydrate metabolism II. Lipid metabolism.
14. Metabolism of proteins and nucleic acids.

Subject Title: Organic Chemistry: Laboratory I

Semester: 3rd

Weekly Load and Assessment: 0/0 /4 c

Credit: 3

Language: English

Course provider: Department of Organic Chemistry

Annotation:

1. Introduction to the laboratory course, safety rules. Demonstration of assembly of chemical apparatus and basic operations of organic synthesis.
2. A selection of one- and two-step syntheses of organic compounds. Separation and identification of products using both classical and modern instrumental means. Practical use of crystallization, filtration and suction filtration.
3. Heating under reflux condenser with magnetic stirring.
4. Distillation under atmospheric and reduced pressure.
5. Water steam distillation.
6. Melting point determination, GLC and TLC chromatography of prepared compounds.

Literature:

1. Laboratory manuals in English are available for students at the beginning of the laboratory course.
2. Hudlický M : Laboratory Experiments in Organic Chemistry. Virginia Polytechnic Institute and State University, Avery Publishing Group Inc., Wayne, N.J. 1990.
3. Vogel A.I.: Vogel's Textbook of Practical Organic Chemistry Longman Scientific and Technical, Essex, England, 5th ed., 1994.
4. and and Technical, Essex, England, 5th ed., 1994.

Subject Title: Physics: Laboratory

Semester: 3rd

Weekly Load and Assessment: 0/0 /3 c

Credit: 2

Language: English

Course provider: Department of Physics and Measurements

Annotation:

1. Introduction
2. Measurement of length and time. Regulation of voltage and current.
3. Weighing on analytical scale and measurement of density.
4. Measuring of viscosity.
5. Measuring of the moment of inertia from time of swing.
6. Measuring of sound propagation speed in gases.
7. Laser radiation and study of diffraction effect. Measuring of focal length of thin lenses.
8. Optical methods in measuring of concentration of matter in solution. Polarimetry, refractometry.
9. Resistors. Transition of measuring instruments range. Compensating measuring method.
10. Measurement of inductivity and capacity.
11. Asynchronous motor. Power and turns regulation.
12. Measurement of transistor amplifier. Voltage stabilization.
13. Detection of ionizing radiation. Measurement of Planck's constant.
14. Measurement of magnetic field. Proof of the Biot-Savart law. Relating magnetic force and field.

Subject Title: Chemical Informatics

Semester: 3rd

Weekly Load and Assessment: 0/2/0 c

Credit: 2

Language: English

Name of lecturer: Ing. Jaroslav Šilhánek, CSc

Ing. Petr Kačer, PhD

Course provider: Department of Physics and Measurements

Objective of the course (expected learning outcomes and competences to be acquired)

Students will get overall understanding of basic principles of communication of scientific knowledge, their distribution, archiving and searching. The aim of the course is to provide students with practical skill in working with information based on standard principles and structures with modern information technologies

Prerequisites

Basic skill in using computers and network communication is expected

Course contents

1. Information as physical and social concept and its specific meaning in science.
2. Mechanism of distribution, storage, and searching of scientific information
3. Analysis, classification and indexing of scientific publications
4. Modern information technologies and their impact on work-up of scientific publication.
5. Concept of scientific databases, different types, structures and usage.
6. General strategy of databases usage, technical and economic aspects.
7. Specific situation in chemistry and some other branches of natural science.
8. Libraries, their organization and usage in past and in present times.
9. Chemical Abstracts as fundamental and indispensable information source for all chemistry disciplines.
10. Chemical compound and its structure as key element of chemical information.
11. Representation of chemical structures in digital form, structure and reaction databases.
12. Patent as specific form of technical and scientific information, patent databases and other aspects of patent information.
13. Toxicological, environmental, biotechnological and other kind of information related to chemistry.
14. Assessment of present situation in chemical information and its perspectives

Recommended reading

Jaroslav Šilhánek: Chemická informatika, Praha 2002.

Jaroslav Šilhánek: Science Citation Index – Web of Science, Praha 2000.

Jaroslav Šilhánek, Ludmila Zetková: Chemical Abstracts on CD-ROM. Praha 1997.

Robert E. Maizell: How to find Chemical Information, J.Wiley 1998.

Damon Ridley: Information Retrieval. SciFinder® and SciFinder® Scholar, J.Wiley 2002.

Johann Gasteiger, Thomas Engel: Chemoinformatics, A Textbook,
J.Wiley-VCH 2003.

Teaching methods
Seminars

Assessment methods
Oral/written examination/practical work

Language of instruction
Czech/English

Subject Title: Fundamentals of Chemical Technologies

Semester: 3rd

Weekly Load and Assessment: 2/0/0 Ex

Credit: 3

Language: English

Course provider: Department of Inorganic Technology

Annotation:

1. Chemical reaction in the technology processes
2. Hydrogen and ammonia production
3. Nitric acid, sulphur acid
4. One-component industrial fertilizers
5. Multi-component industrial fertilizers
6. Sodium hydroxide and chlorine production
7. Steel and aluminium production
8. Raw material base of organic productions, renewable resources
9. Coal, natural gas, C1 chemistry
10. Crude oil and its refinery treatment
11. Petrochemistry
12. Hydrogenation and dehydrogenation
13. Esterification and hydrolysis
14. Acid catalysed reactions

Subject Title: Introduction to Study of Materials

Semester: 3rd

Weekly Load and Assessment: 2/0/0 Ex

Credit: 3

Language: English

Course provider: Department of Solid State Chemistry

Annotation:

1. Materials – definition, classification; history of materials
2. Chemical bond and internal structure of materials
3. Functional properties of materials (mechanical, electrical, magnetic, optical, thermal)
4. Ceramics
5. Glass
6. Polymers – preparation, structure, properties
7. Plastics, rubber, resin
8. Conductors, semiconductors, insulators, superconductors
9. Optical and magnetic materials
10. Iron and ferrous alloys
11. Nonferrous metals and alloys
12. Building materials
13. Composite materials
14. Degradation of materials

Subject Title: Organic Chemistry II

Semester: 3rd

Weekly Load and Assessment: 2/1 /0 c, Ex

Credit: 4

Language: English

Course provider: Department of Organic Chemistry

Annotation:

1. Saccharides – monosaccharides, their structure, stereochemistry, and reactions.
2. Oligo – and polysaccharides.
3. Halogen- , hydroxy- , and unsaturated carboxylic acids.
4. Amino acids, peptides , primary structure.
5. Oxo acids and their synthetic utilisation.
6. Heterocycles.
7. Chemistry of nucleosides, nucleotides and NA.
8. Organic synthesis – methods for alkanes, alkenes, alkynes.
9. Synthetic procedures for monofunctional compounds.
10. Synthesis of aldehydes, ketones and carboxylic acids.
11. Synthesis of functionalized carboxylic acids.
12. Synthesis of heterocycles.
13. Natural products.
14. Methods used for structure determination.

Subject Title: Physics II

Semester: 3rd

Weekly Load and Assessment: 2/2 /0 c, Ex

Credit: 5

Language: English

Course provider: Department of Physics and Measurements

Annotation:

1. Electromagnetic field: Maxwell's equations, electromagnetic waves (properties, energy transfer, intensity, polarization).
2. Special relativity: principles, the Lorentz transformation, length contraction, time dilation, velocity transformations. Relativistic dynamic quantities. The mass-energy equivalence.
3. Introduction to quantum physics: Blackbody radiation, the Stefan-Boltzmann law, spectral intensity distributions, the Planck distribution law. Absorption and emission. Laser.
4. Electrons and photons: The photoelectric effect, threshold wavelength and frequency, stopping potential. The Compton effect, X rays, X ray diffraction by a crystal.
5. Wave nature of particles: De Broglie wavelength, electron diffraction by a crystal lattice, electron microscope. The particle-wave duality, the uncertainty principle.
6. Basics of quantum mechanics: wave function and its properties, the probability density. Operators: eigenvalue equations and eigenvalues. The Schroedinger equation.
7. Quantum mechanical solution of simple problems I: Free particle, particle in an infinite square well, energy spectrum, degeneracy.
8. Quantum mechanical solution of simple problems II: Tunnel effect, the harmonic oscillator, energy spectrum of the linear harmonic oscillator. The correspondence principle.
9. The hydrogen atom: particle in a Coulomb potential, energy levels, the atomic spectrum. Quantum numbers of the hydrogen atom, the radial probability density.
10. Quantum mechanical solution of the hydrogen and hydrogen-like atoms: Contour diagrams. The Zeeman effect. Spin of the electron, fine structure of energy levels, spin-orbit interaction.
11. Many-electron atoms: The orbital approximation, effective charge of a nucleus, screening. The building-up principle, the Hund rule, the Pauli exclusion principle.
12. Introduction to solid state physics: Band structure of energy levels of solids. The Fermi-Dirac distribution, the Fermi energy. Intrinsic and extrinsic semiconductors, p-n junction.
13. Applications of the p-n junctions: Diodes, semiconductor rectifiers, transistor amplifiers, thyristors, integrated circuits.
14. Introduction to nuclear physics: Selected properties of atomic nuclei, radioactive decay, radioactivity, measurement of the dose rate. Model of the nuclear fission, nuclear reactor.

Subject Title: Fundamentals of Marketing Chemical Products

Semester: 3rd

Weekly Load and Assessment: 2/0/0 Ex

Credit: 3

Language: English

Course provider: Doc.Ing. Stanislava Grosová, CSc.

Annotation:

1. The role of marketing in organizations. Marketing management. Marketing strategy
2. Marketing environment – customers, competitors, trends in macroenvironment.
3. Consumer and Industrial markets. Industrial Buying Process.
4. Market segmentation and product positioning.
5. Brand management.
6. Product – quality, packaging, application services
7. New product development and market introduction
8. Price and pricing.
9. Distribution channels
10. Marketing communication. Public relations. Sales promotion.
11. Personal selling.
12. Sales force management.
13. Key account management.
14. Sales promotion. Public relations. Direct marketing.
15. Market intelligence.

Subject Title: User Software

Semester: 3rd

Weekly Load and Assessment: 0/3/0 c

Credit: 3

Language: English

Course provider: Department of Organic Technology

Annotation:

1. Operation and network systems: Windows, Novell, managers, configuration, access rights, networks
2. Text processor (MS Word) – advanced methods of text processing, using and handling styles, equations, templates
3. Text processor – advanced techniques: objects, graph and data import, lists, indexes, long documents
4. Spreadsheet (MS Excel) – revision, basic knowledge broadening, space blocks, files interlinking – work with several files
5. Spreadsheet – graph possibilities, mathematical calculations, systems of equations, solver
6. Spreadsheet – data handling and analysis, statistical calculations
7. Spreadsheet – data import, export and handling, databases in Excel, advanced techniques, macros
8. Matlab – integrated user environment - basics
9. Matlab – calculations and graphics
10. Matlab – programming and library utilization
11. Matlab – data sharing and applications
12. Results presentation in electronic form – MS PowerPoint – basics
13. MS PowerPoint – animation, sounds linking; electronic mail, Outlook
14. Credit test – individual problem solving

Subject Title: Inorganic Chemistry: Laboratory II

Semester: 3rd

Weekly Load and Assessment: 0/0/4 c

Credit: 3

Language: English

Course provider: Department of Inorganic Chemistry

Annotation:

1. Chemistry of non-transition and transition metals
2. Preparation of metals and compounds by different technique -melting, precipitation
3. Mass balance of chemical reactions
4. Oxidation - reduction reactions of metal compounds
5. Preparation of coordination compounds
6. Ion exchange chromatography
7. Wasteless technology - preparation series
8. Analytical important reactions of metal cations
9. Qualitative determination of metal cations in unknown samples

Subject Title: Chemical Engineering I

Semester: 4th

Weekly Load and Assessment: 2/3 /0 c, Ex

Credit: 6

Language: English

Course provider: Department of Chemical Engineering

Annotation:

1. Basic concepts. Classification of systems. Fundamentals of balances. Balances of mass and molar amount.
2. Balances of energy, enthalpy and momentum. Bernoulli equation and equation of hydrostatics.
3. Flow of fluids through pipelines. Transport of fluids, pumps. Flow of fluids through the layer of granular material.
4. Filtration, types of filters, rate of filtration. Sedimentation, sedimentation velocity, sedimentation equipment.
5. Fluidization, fluidization equipment, description of fluidized bed reactor. Mixing, mixing equipment. Residence time.
6. Heat transfer by conduction, convection and radiation. Local and overall heat transfer. Heat transfer coefficients.
7. Heat exchangers: types of equipment and calculation of different types. Evaporators: types of equipment, balances. Crystallization.
8. Diffusion separation processes. Separators. Equilibrium stage.
9. Membrane separation processes, types of membranes and modules, driving forces, calculations of membrane modules.
10. Liquid-liquid extraction, extractors. One step, repeated and counter-current extraction.
11. Equilibrium and differential distillation of binary mixtures. Rectification of binary mixtures.
12. Absorption, types of absorbers, number of equilibrium stages, height of packed absorption column. Adsorption.
13. Drying of solids, enthalpy diagram of wet air, batch and continuous dryers.
14. Chemical reactors and bioreactors, basic types. Molar and enthalpy balances.

Subject Title: Analytical Chemistry I

Semester: 4th

Weekly Load and Assessment: 2/1 /0 c. Ex

Credit: 4

Language: English

Course provider: Department of Analytical Chemistry

Annotation:

1. Analytical chemistry, its functions and applications
2. Solution equilibria, pH
3. Titrimetry, gravimetry
4. Electrochemical methods
5. Extraction, principles of chromatography
6. Principles of chromatography, gas chromatography
7. Liquid chromatography, capillary electrophoresis and electrochromatography
8. Principles, spectrometric instrumentation
9. Atomic spectrometry
10. Molecular spectrometry
11. Molecular spectrometry
12. Mass spectrometry, combined techniques
13. Thermogravimetry, sensors, automated procedures
14. Errors in analytical measurements Errors in analytical measurements

Subject Title: Applied Statistic

Semester: 4th

Weekly Load and Assessment: 1/2/0 c, Ex

Credit: 4

Language: English

Course provider: Department of Mathematics

Annotation:

1. Events and random experiment. Probability, calculus of events probability, combinatorial formulas. Conditional probability, independent events Bayes's theorem.
2. Random variable, distribution of random variable. Distribution function definition and properties. Probability function and probability density.
3. Mean, variance, quartiles (quartiles, percentiles). Simple functions of random variable.
4. Multivariable random variables. Independence and Correlation of random variables. Covariance and correlation matrix.
5. Basic types of discrete probability distribution application examples.
6. Basic types of continuous probability distributions Normal (Gaussian) distribution, Log-normal distribution, Student t- distribution, F-distribution. Tables of distribution quantiles and manipulation with them.
7. Random sample, sample space, sample estimator of distribution parameters, sorted sample, histograms. Random sample of Normal distributions.
8. The point estimators of unknown distribution parameters. Interval estimation and basic principle of setting it up.
9. Testing a Statistical Hypothesis. Null and Alternative Hypothesis, testing criterion, Errors of I. and II. type, probability level of test p-value. One-sample tests
10. Two-sample testing. Circumstances and fitness of using in different situations.
11. The confirmation of actual type of distribution (particularly Normal distribution). Goodness of Fit test condition of using, examples.
12. Evaluation of mutual dependency of random variables. Independency test. Analysis of contingency table, examples.
13. Regression analysis, linear regression model. Point and interval estimation of regression curve parameters. Tests of this parameters, prediction and variability region of regression curve. Application examples.
14. Complementary and statistical methods concluding lecture.

Literature:

1. Pavlik J. at all : Sbirka prikladu z pravdepodobnosti a matematicke statistiky. VŠCHT Prague, 1999. (in Czech)
2. Freund J.E., Walpole R.E.: Mathematical Statistics. III. ed. Prentice Hall Inc. Englewood Cliffs New Jersey 07632.

Subject Title: Physical Chemistry: Laboratory I

Semester: 4th

Weekly Load and Assessment: 0/0/4 c

Credit: 3

Language: English

Course provider: Department of Physical Chemistry

Annotation:

1. Calorimetry I - heat of solution of inorganic salts
2. Kinetics of first-order reaction
3. Ideal-gas equation of state - determination of molar mass by V. Meyer's method
4. Colligative properties I – boiling point elevation
5. Colligative properties II – freezing point depression
6. One-component phase equilibrium - saturated vapour pressure of liquids
7. Phase diagrams of two-components condensed system – solid–liquid equilibrium
8. Phase diagram of three-components condensed system – liquid–liquid equilibrium
9. Conductivity of electrolytes - solubility product, infinite-dilution molar conductivity
10. Temperature dependence of solubility of salts

Subject Title: Physical Chemistry II

Semester: 4th

Weekly Load and Assessment: 3/2 /0 c, Ex

Credit: 7

Language: English

Course provider: Department of Physical Chemistry

Annotation:

1. Real behaviour of gases, liquids and their mixtures (virial and multiconstant equations of state, CS theory).
2. Application of the 1st law of thermodynamics, temperature and pressure dependence of state functions.
3. Consequences of the 2nd law of thermodynamics, efficiency of heat engines, heat pumps.
4. Irreversible processes, Joule-Thomson coefficient, inversion temperature, condensation of gases.
5. Energetics of chemical reactions, reaction heat and methods for its determination.
6. Spontaneous changes and Gibbs energy. Chemical equilibrium in real systems.
7. Yield of chemical reaction, decompositions of solid substances, simultaneous equilibria.
8. Theory of electrolytic dissociation, equilibria in electrolyte solutions, pH, solubility constants.
9. Equilibrium electrochemical cells, classification, cells as energy sources.
10. Phase equilibria in real binary systems (l-g, l-l, s-l). Colligative properties.
11. Ternary systems, Nernst distribution law, phenomena on phase boundaries.
12. Diffusion, migration of ions in electric field, conductivity, Kohlrausch law.
13. Kinetics of simultaneous reactions, reversible reactions and chemical equilibrium.
14. Mechanism of chemical reactions, photochemistry, catalysis.

Subject Title: Organic Chemistry: Laboratory II

Semester: 4 th

Weekly Load and Assessment: 0/0 /4 c

Credit: 3

Language: English

Course provider: Department of Organic Chemistry

Annotation:

1. The two- and multi-step syntheses of exact organic compounds which covers:
2. Improvement of students' skills in laboratory techniques obtained in the Organic Chemistry Laboratory I
3. Separation of mixtures on solid layers
4. Analysis of mixtures on solid layers
5. Syntheses of selected compounds according to Organic Synthesis
6. Syntheses adapted to semi-micro and micro scale operations

Literature:

1. Laboratory manuals in English are available for students at the beginning of the laboratory course.
2. Hudlický M : Laboratory Experiments in Organic Chemistry. Virginia Polytechnic Institute and State University, Avery Publishing Group Inc., Wayne, N.J. 1990.
3. Vogel A.I.: Vogel's Textbook of Practical Organic Chemistry Longman Scientific and and Technical, Essex, England, 5th ed., 1994.

Subject Title: Characterization Methods for Substances

Semester: 4th

Weekly Load and Assessment: 2/2/0 c,Ex

Credit: 5

Language: English

Course provider: Department of Glass and Ceramics

Annotation:

1. Description of radiation and particles.
2. Characterization of atoms, molecules, and solid state.
3. Spectrum - its origin and substance. Interactions between a particle and solid state.
4. X-ray spectral analysis.
5. Scanning electron microscopy.
6. Electron transmission microscopy.
7. Electron probe microanalysis.
8. Ion mass spectroscopy.
9. Structure and properties of the surface.
10. Methods for the characterization of the surface.
11. LEED, RBS, IIS, and AES.
12. X-ray photoelectron spectroscopy.
13. Scanning probe microscopy.
14. Synchrotron radiation. EXAFS, ELNES, EXELFS, XANES.

Subject Title: Environmental Protection Processes

Semester: 4th

Weekly Load and Assessment: 2/1/0 c,Ex

Credit: 4

Language: English

Course provider: Department of Organic Technology

Annotation:

1. Recycling and regeneration of raw materials, green chemistry
2. Typical waste sources, environmental assessment
3. Treatment of wastes from inorganic chemistry, exhalates
4. Solid inorganic wastes, solidification
5. Waste-water treatment
6. Membrane separation in electrical field
7. Electrolysis in environmental protection
8. Principles of sustainable chemical technology
9. Catalytic treatment of VOC
10. Chemical treatment of organics in process water
11. Advanced oxidation processes, ozonization
12. Fenton oxidation, secure operation
13. Wet oxidation of polluted water
14. Treatment process evaluation, engineering

Subject Title: Macromolecular Chemistry

Semester: 4th

Weekly Load and Assessment: 2/1 /0 c, Ex

Credit: 4

Language: English

Course provider: Department of Polymers

Annotation:

1. Introduction and historical development, nomenclature of polymers.
2. Structure of macromolecules, molecular weight.
3. Molecular structure and properties of polymers.
4. Polymerizability of low molecular substances.
5. Free radical polymerization – elemental reactions.
6. Kinetics of free radical polymerization.
7. Free radical copolymerization.
8. Ionic polymerization and copolymerization.
9. Insertion polymerization, polymerization practice.
10. Ring-opening polymerization.
11. Step-growth polymerization – characterization, reactivity of monomer functional groups.
12. Polycondensation - mechanism and kinetics, molecular weight distributions.
13. Polyadditions - typical syntheses.
14. Reactions of polymers.

Subject Title: Chemical Database Systems

Semester: 4th

Weekly Load and Assessment: 0/2/0 c

Credit: 2

Language: English

Course provider: Department of Organic Technology

Annotation:

1. Chemistry database systems, history, present status and future,
2. Basic concepts of chemical information workup in classical and electronic forms.
3. Textual and topic description of chemical information and their usage in databases.
4. Chemical compound as key concept of chemistry databases.
5. Alternative forms of descriptive identification of chemical compounds and substance.
6. Basic concepts of chemical nomenclature systems and possibility of their recording in electronic form.
7. Descriptive identification of chemical compounds and its computer representation
8. Electronic representation of chemical structures in their graphical forms.
9. Structure databases and their general concepts.
10. Detailed description of structure databases usage and query formulation.
11. Existing chemistry structure databases, advantages of individual products.
12. Reaction databases, their general concepts and present possibilities.
13. Structure searches in patent databases, Markush databases and their usage.
14. Future of chemistry databases from point of view their accessibility and usage.

Recommended reading

Jaroslav Šilhánek: Chemická informatika, Praha 2002.

Jaroslav Šilhánek: Science Citation Index – Web of Science, Praha 2000.

Jaroslav Šilhánek, Ludmila Zetková: Chemical Abstracts on CD-ROM. Praha 1997.

Robert E. Maizell: How to find Chemical Information, J.Wiley 1998.

Damon Ridley: Information Retrieval. SciFinder® and SciFinder® Scholar, J.Wiley 2002.

Johann Gasteiger, Thomas Engel: Chemoinformatics, A Textbook, J.Wiley-VCH 2003.

Teaching methods

Seminars

Assessment methods

Oral/written examination/practical work

Language of instruction

Czech/English

Subject Title: Chemical Engineering: Laboratory

Semester: 5th

Weekly Load and Assessment: 0/0 /3 c

Credit: 2

Language: English

Course provider: Department of Chemical Engineering

Annotation:

1. Groups of (usually) 3 students will obtain practical experience with unit
2. operations and equipment used in chemical manufacturing and food processing.
3. The group is assigned to make the prescribed measurements, to process the
4. experimental data and to elaborate the written report containing the measured results.
5. The written report also has to contain the conclusions.
6. List of assigned measurements:
7. Hydromechanical operations: Loss of mechanical energy during the fluid flow,
8. Characteristics of the centrifugal pump, Power input of the mixer, Filtration,
9. Sedimentation, Pressure drop during the fluid flow through the packed column.
10. Mechanical processes: Ball mill.
11. Heat transfer processes: Heat exchanger “tube in tube”. Heat transfer coefficient on
12. ribbed heat-exchange surface.
13. Separation processes: Rectification, Absorption, Drying, Reverse Osmosis.
14. Reactor engineering: Measurement of residence time distribution in flow-through vessel.

Subject Title: Analytical Chemistry: Laboratory I

Semester: 5th

Weekly Load and Assessment: 0/0/6 c

Credit: 4

Language: English

Course provider: Department of Analytical Chemistry

Annotation:

1. Gravimetry, complex-formation titrations with EDTA
2. Fluoride ion selective electrode
3. Potentiometric titration
4. Infrared spectrometry
5. Liquid chromatography
6. Coulometry
7. Spectrophotometry

Subject Title: Chemical Engineering: Project

Semester: 5th

Weekly Load and Assessment: 0/1 /0 c

Credit: 1

Language: English

Course provider: Department of Chemical Engineering

Annotation:

1. Application of chemical engineering on more difficult problems, e.g. problems that include several unit operations or problems that require non-standard approaches, is the main aim of the course. The solved tasks should simulate real situations that appear in industry. A group of students (usually three-person) independently solves the assigned problems. It can help students to learn the principle of the team work. The students can consult the progress with a teacher. The solved problems demand a complex analysis, selection of a suitable method, bibliographic and/or technical search, and solution of the problems. Students prepare a written report that includes a scheme of the relevant chemical engineering operations, description of the used procedure for solution of the problem, solution of the problem, relevant tables and graphs, and bibliographic citations. The results of the work are defended in discussion with the teacher.

Subject Title: **Data Acquisition and Data Treatment**
Semester: 5th
Weekly Load and Assessment: 1/2 /0 c, Ex
Credit: 4
Language: English
Course provider: Department of Organic Technology

Annotation:

1. Measurements in technical practice - objectives, design and evaluation, documentation.
2. Properties of industrial and laboratory data.
3. Measurements of basic quantities, systems of units, dimensions.
4. Estimation of physicochemical data, data sources in chemical informatics.
5. Data acquisition from mathematical models of chemical processes.
6. Simulation programs of chemical processes.
7. Statistical data handling, examples.
8. Statistical data analysis software, data plotting.
9. Data acquisition by means of mathematical models, principles of modelling.
10. Mechanistic model building, characteristics, practical utilisation.
11. Empirical model selection, characteristics, practical utilisation.
12. Parameter estimation methods, non-linear, multivariable and multiresponse regression, software.
13. Evaluation of regression analysis quality, reliability of regression parameters.
14. Experimental design for regression.

Literature:

1. Box G. E. P., Hunter W. G., Hunter J. S.: Statistics for Experimenters – An Introduction to Design, Data Analysis and Model Building. Wiley, New York 1978.
2. Ryan T. P.: Modern Regression Methods. Wiley, New York 1997.

Subject Title: Raw Materials in Chemical Industry

Semester: 5th

Weekly Load and Assessment: 2/1/0 c,Ex

Credit: 4

Language: English

Course provider: Department of Organic Technology

Annotation:

1. Object information's content, relationship between chemical production, power and environment
2. Raw materials for electrolytic production of NaOH, chlorine and its compounds
3. Nitrogen, ammonia, nitric acid
4. Phosphorus and sulfur containing raw materials, manufacture of fertilizers
5. Raw material for glass manufacture, recovery and treatment
6. Inorganic binders: raw materials and basic products
7. Ceramic and refractory materials
8. Crude oil: occurrence, recovery, composition, primary and secondary processing
9. Ethylene production by steam cracking, raw material base for petrochemistry
10. Materials for polymers production
11. Natural gas, production of hydrogen, syngases and carbon oxides
12. Coal: present and future utilization in power and chemical industries
13. Renewable carbonaceous sources, power utilization of biomass
14. Control test

Subject Title: Catalysis

Semester: 5th

Weekly Load and Assessment: 2/1/0 c,Ex

Credit: 4

Language: English

Course provider: Department of Organic Technology

Annotation:

1. Principle of accelerating and directing chemical reactions
2. Heterogeneous, homogeneous and enzyme catalysis
3. Structure and properties of catalytic complexes
4. Thermodynamic limits of catalysis
5. Kinetics of catalyzed reactions
6. Transport phenomena in solid catalysts
7. Texture of solid catalysts
8. Testing of catalytic activity
9. Characterization of catalysts I (methods: AES, EMPA, ESCA)
10. Characterization of catalysts II (methods:DR-FTIR, LBA, ISS,LEED, SIMS)
11. Characterization of catalysts III (methods: SAXS, SEM, XDA, EXAFS)
12. Manufacture, deactivation and regeneration of catalysts
13. Examples of catalytic applications in various industries
14. Environmental catalysis

Subject Title: Materials Corrosion

Semester: 5th

Weekly Load and Assessment: 2/1/0 c, Ex

Credit: 4

Language: English

Course provider: Department of Metals and Corrosion Engineering

Annotation:

1. Thermodynamics and kinetics of metallic corrosion.
2. Environmental and metallurgical factors in metallic corrosion.
3. Corrosion types and their mechanismus.
4. Metallic corrosion in different environments.
5. Corrosion protection of metals by alloy and coating selection.
6. Electrochemical protection, environment modification, design.
7. Corrosion literature, testing and monitoring.
8. Plastics, terms definition, thermal resistance.
9. Weathering, photochemical processes, plastics stabilization.
10. Chemical resistance of plastics, environmental aspects.
11. Dissolution of inorganic nonmetallic substances in liquids.
12. Silicate glasses corrosion in aqueous solutions.
13. Protective enamel coatings on metals.
14. Corrosion of ceramics and concrete.

Subject Title: Chemical Engineering II

Semester: 5th

Weekly Load and Assessment: 2/3/0 c, Ex

Credits: 6

Language: English

Course provider: Department of Chemical Engineering

Annotation:

1. Fluid mechanics, equation of continuity, equations of motion, fluid flow in pipes.
2. Flow out of reservoirs – containers, hazards and safety. Centrifuges and cyclones.
3. Flow through beds of solids, pressure drop. Multi-phase flow.
4. Hydromechanical separations of dispersion systems. Kinetics of filtration. Settling.
5. Dispersion systems. Fluidization: quantitative description of fluidized bed. Bubble columns.
6. Dimensional analysis, dimensionless groups, correlations. Principles of modelling. Analogy.
7. Radiation heat transfer. Heat exchange in flowing fluids; cooling, heating and sterilization.
8. Convective and diffusive mass transfer. Mass exchange at interfaces.
9. Mass transfer: concepts of equilibrium-stage and diffusional processes.
10. Continuous rectification of binary and multi-component mixtures.
11. Membrane processes: gas permeation, reverse osmosis, pervaporation, ultrafiltration.
12. Continuous stirred tank reactor, cascades. Tubular reactor. Heterogeneous reactors. Reactors with nonideal flow.
13. Bioreactors, microorganism cultivation, growth and production. Fermentors, enzyme reactors.
14. Adsorption and chromatography. Crystallization from solutions. Crystallizers.

Subject Title: Analytical Chemistry II

Semester: 5th

Weekly Load and Assessment: 2/1 /0 c, Ex

Credit: 4

Language: English

Course provider: Department of Department of Analytical Chemistry

Annotation:

1. Analytical chemistry in applications (requirements, techniques, examples)
2. Security
3. Criminalistics
4. Cultural heritage
5. Materials
6. Microcosmos
7. Foods
8. Processes
9. Sensors
10. Sport and household
11. Structure
12. Cosmos
13. Health
14. Environment

Subject Title: Physical Chemistry: Laboratory II

Semester: 5th

Weekly Load and Assessment: 0/0/3 c

Credit: 2

Language: English

Course provider: Department of Physical Chemistry

Annotation:

1. Calorimetry II - enthalpy of combustion
2. Kinetics of second-order reaction
3. Measurement of cell electromotive force - determination of activity coefficients
4. Partial molar volumes in binary system
5. Two-components phase equilibrium - vapour-liquid equilibrium
6. Activation energy of first- and second-order reactions

Subject Title: Pharmacochemistry

Semester: 5th

Weekly Load and Assessment: 2/0 /0, Ex

Credit: 3

Language: English

Course provider: Department of Organic Chemistry

Annotation:

1. Introduction. Basic terms and definitions.
2. Mutual drug and organism interactions. Basic terms in pharmacology.
3. Drug design methods. Registration of drugs. Good manufacturing practice.
4. Analgesics, antipyretics, anti-inflammatory agents.
5. Central nervous system drugs: anaesthetics, sedatives, hypnotics.
6. Central nervous system drugs: psychiatric drugs.
7. Autonomous nervous system drugs: sympathomimetics and sympatholytics.
8. Autonomous nervous system drugs: parasympathomimetics and parasympatholytics.
Local anaesthetics and muscle relaxants.
9. Antihistamines and antiallergics. Antitussives and expectorants.
10. Cardiovascular system drugs.
11. Digestive tract therapeutic agents.
12. Antiinfective agents.
13. Chemotherapy of cancer.
14. Vitamins a hormones.

Subject Title: Fundamentals of Computer Simulation

Semester: 5th

Weekly Load and Assessment: 2/2/0 c, Ex

Credit: 5

Language: English

Course provider: Department of Inorganic Technology

Annotation:

1. Chemical process design principles, types of projects in chemical technology design
2. Balance scheme development, material and energy balances, scheme structure
3. Flowsheet simulation, flowsheet simulation programs and their general structure
4. Static and dynamic simulation, sequential and global approach
5. Simulation software overview
6. Choice of chemical reactor, reaction pathway and economic potential, reactor performance
7. Models of chemical reactors, chemical reactors modules in simulation programs
8. Models of heterogeneous mixture separators
9. Models of homogeneous mixture separators
10. Heat management in chemical processes, heat exchangers and heat exchanger networks
11. Heat exchanger models
12. Safety of chemical processes, waste treatment and their minimization
13. Economic evaluation of chemical process design, quality management systems
14. Local and global optimization of chemical processes

References

1. R. Smith, Chemical Process Design, McGraw-Hill, Inc., New York, 1995, ISBN 0-07-059220-9
2. J.L.A. Koolen, Design of Simple and Robust Process Plant, Wiley-VCH, Weinheim, 2001, ISBN 3-527-29784-7

Subject Title: Safety Legislation in Chemistry

Semester: 5th

Weekly Load and Assessment: 2/0/0 Ex

Credit: 3

Language: English

Course provider: Department of Inorganic Chemistry

Annotation:

1. Act on chemical substances and chemical preparations and on an amendment to certain other acts (356/2003)
2. Source of information to realization act 356/2003 – description single database, indices materials amenable registration
3. Material Safety Data Sheet (MSDS), R,S-phrases, packaging, labelling
4. Decree of the Government No 258/2001 Coll. – List of hazardous chemical substances and chemical preparations
5. Placing of selected hazardous substances and preparations on the market and putting them into circulation
6. General principles of the classification of substances and preparations- conventional calculation methods for evaluating the hazardous properties of preparations based on their physical and chemical features, hazardous to human health and hazardous to the environment.
7. Hazardous reactions of common chemical substances and chemical preparations
8. Hazardous substances, minimum concentrations of hazardous substances to be taken into account for classifications of substances and preparations, concentration limits for changes to the classification of hazardous preparations
9. First aid measures, after inhalation, skin contact, eye contact.....
10. Act on chemical substances and chemical preparations and on an amendment to certain other acts in practice
11. Law on the prevention of major accidents caused by selected chemical substances and chemical preparations in the wording of later regulations
12. Regulation (EC) No 761/2001 allowing voluntary participation by organisations in a Community eco-management and audit scheme
13. Act No 185/2001 on waste and amendment of some other acts
14. Preparations and productions of dangerous chemical substances and chemical preparations (Examples of explosives, oxidizer, highly inflammable, highly toxic etc.)

Subject Title: Analytical Chemistry: Laboratory II

Semester: 6th

Weekly Load and Assessment: 0/0/4, c

Credit: 3

Language: English

Course provider: Department of Analytical Chemistry

Annotation:

1. Atomic absorption spectrometry
2. Gas chromatography
3. NMR spectrometry
4. Fluorimetry
5. Flow injection analysis
6. Near infrared spectrometry

Subject Title: Structural Analysis

Semester: 6th

Weekly Load and Assessment: 2/1 /0 c, Ex

Credit: 4

Language: English

Course provider: Department of Organic Chemistry

Annotation:

The basic aim of this course is to gain knowledge about principles and practical use of spectroscopic method in the field of organic chemistry.

1. Overview of molecular spectroscopy methods, base conception and principles
2. NMR, base info, main conceptions, range of application
3. ¹H NMR in organic structure analysis
4. ¹³C NMR in organic structure analysis
5. Special techniques of NMR
6. 2D NMR - COSY, HETCOR
7. Infrared spectroscopy, base conception and principles
8. Characteristic vibrations and „finger print“ region
9. Applications in structure analysis
10. UV-VIS spectroscopy, base conception and principles
11. Practical applications in structure analysis
12. Mass spectra, fundamental of method, experimental arrangement
13. Ionisation technique, separation techniques, basic types of fragmentation
14. Application in structure analysis of organic compounds

Subject Title: Fine Chemicals

Semester: 6th

Weekly Load and Assessment: 2/1/0 c,Ex

Credit: 4

Language: English

Course provider: Department of Organic Technology

Annotation:

1. General chemical and physical properties of inorganic pigments
2. Color properties, color measurement
3. Behavior of pigments in binders
4. White pigments
5. Titanium dioxide
6. Colored pigments
7. Magnetic, anticorrosive, luster and transparent pigments
8. Organic dyes and pigments
9. Surface- active agents
10. Ionic and nonionic surfactants
11. Biologically active compounds
12. Pesticides
13. Flavours and fragrances
14. Polymer aditives

Subject Title: Safety in Chemical Production

Semester: 6th

Weekly Load and Assessment: 2/1/0 c,Ex

Credit: 4

Language: English

Course provider: Department of Organic Technology

Annotation:

1. Structure of hazard in production and application of chemicals
2. Sources of hazard in chemical plants
3. Risk analysis: examples of typical sources of hazard in chemical plants
4. Processes involving compressed gases, liquefied gases and overheated liquids
5. Toxic and eco-toxic substances
6. Registers of releases and transfers of dangerous substances
7. Static electricity as a source of hazard
8. Exothermic chemical reactions as a source of hazard
9. Dangerous processes involving exothermic chemical reactions
10. Safe control of exothermic chemical reactions
11. Hazards in treating explosive and flammable substances
12. Case studies: explosive and flammable substances
13. Information system for transport of dangerous chemical substances
14. Information sources and databases, communication with the public

Subject Title: Applied Chemical Processes

Semester: 6th

Weekly Load and Assessment: 2/1/0 c,Ex

Credit: 4

Language: English

Course provider: Department of Inorganic Technology

Annotation:

1. Liquid-gas neutralisation processes
2. Solid-liquid conversion and precipitation
3. Heterogeneous non-catalytic reactions
4. Solid state dissolution with chemical reaction
5. Low temperature processes
6. Catalysis in hydrogen production
7. Catalysis in nitrogen industry
8. Catalysis in sulphur industry
9. Absorption, adsorption and membrane processes
10. Equilibria processes with circulating components
11. Electrochemical processes with cathodic reduction
12. Electrochemical processes with anodic oxidation
13. Electromembrane processes
14. Electrothermic processes

Faculty of Chemical Technology

STUDY PROGRAMME: Applied Chemistry and Materials

Field of Study: Chemistry and Technology of Materials

Characteristics:

The study prepares experts with a broad technical and chemical education for work in various fields of research, manufacture, application, and in the field of commerce. In addition to fundamental chemical-technological education, students may choose special subjects according to their specialization. They gain practical knowledge of the manufacture and properties of chemical products such as biomaterials for medical purposes, glass, ceramics, or materials of special properties, plastics and synthetic rubber. They get acquainted with processes applied in metal surface treatment and protection, with problems relating to the protection and restoration of cultural monuments, and with environment-friendly ways of waste processing. Students learn to apply advanced analytical methods in raw materials input control, inter-operational control and product quality analysis. They get to know analytics applied in monitoring environmental pollution. They acquire practical skills in using computers for technical and administrative purposes and learn advanced methods of manufacturing management. If they wish, they may also substantially expand their knowledge of foreign languages.

Graduate profile:

The broad choice of subjects offered within the study programme allows graduates to start their careers or to continue their studies in related engineering (equal to MSc) study programmes. They may pursue careers in research or in industry oriented on materials manufacture and treatment. They may also work in consulting agencies, designing companies, technical trade organizations, and in home and foreign trade companies. Given their technology-oriented synthetic way of thinking acquired during studies, graduates may also work in other engineering fields after some training.

Study Year: 1

Winter Semester

<i>Code</i>	<i>Required Subjects</i>	<i>Dep.</i>	<i>L</i>	<i>S</i>	<i>Lab</i>	<i>Assessment</i>	<i>Credits</i>
Required Subjects							
N101005	General and Inorganic Chemistry I	101	3	2	0	c,Ex	8
N413002	Mathematics I	413	3	3	0	c,Ex	9
N111009	Toxicology and Ecology	111	2	0	0	Ex	3
N445001	Applications of Computer Science	445	0	3	0	c	3
N101002	Chemical Calculations	101	0	2	0	c	2
N437005	Enterprise Economics	437	2	1	0	c,Ex	4
N963006	Introduction to Studies	963	1	0	0	c	1
N827001	Physical Education	827	0	2	0	c	0

Summer Semester

<i>Code</i>	<i>Required Subjects</i>	<i>Dep.</i>	<i>L</i>	<i>S</i>	<i>Lab</i>	<i>Assessment</i>	<i>Credits</i>
Required Subjects							
N110004	Organic Chemistry I	110	3	2	0	c,Ex	7
N444001	Physics I	444	3	2	0	c,Ex	7
N101003	Inorganic Chemistry: Laboratory I	101	0	0	4	c	3
N437003	Management of Enterprise Processes	437	2	1	0	c,Ex	4
N834001	Language I	834	0	2	0	c	0
N827002	Physical Education	827	0	2	0	c	0
Semi-elective Subjects 1 and 2							
N413003	Mathematics II	413	3	3	0	c,Ex	8
N101006	General and Inorganic Chemistry II	101	2	2	0	c,Ex	5
N832013	Law Basics	832	2	0	0	Ex	3
N832011	Human Resources Management	832	2	1	0	c,Ex	4
Recommend Subject							
N444002	Fundamentals of Physics: Repetition	444	0	2	0		0
Elective Subjects							
	Elective Subjects for the 2nd Semester						

Study Year: 2

Winter Semester

<i>Code</i>	<i>Required Subjects</i>	<i>Dep.</i>	<i>L</i>	<i>S</i>	<i>Lab</i>	<i>Assessment</i>	<i>Credits</i>
Required Subjects							
N403011	Physical Chemistry I	403	3	2	0	c,Ex	7
N320001	Biochemistry I	320	3	0	0	Ex	5
N110002	Organic Chemistry: Laboratory I	110	0	0	4	c	3
N444003	Physics: Laboratory	444	0	0	3	c	2
N111003	Chemical Informatics	111	0	2	0	c	2
N105004	Fundamentals of Chemical Technologies	105	2	0	0	Ex	3
N108004	Introduction to Study of Materials	108	2	0	0	Ex	3
N834002	Language II	834	0	2	0	c,Ex	0
N827003	Physical Education	827	0	2	0	c	0
Semi-elective Subject 3							
N110005	Organic Chemistry II	110	2	1	0	c,Ex	4
N444006	Physics II	444	2	2	0	c,Ex	5
N437022	Fundamentals of Marketing Chemical Products	437	2	0	0	Ex	3
N111008	User Software	111	0	3	0	c	3
N101004	Inorganic Chemistry: Laboratory II	101	0	0	4	c	3
Elective Subjects							
	Elective Subject for 3rd Semester						

Summer Semester

<i>Code</i>	<i>Required Subjects</i>	<i>Dep.</i>	<i>L</i>	<i>S</i>	<i>Lab</i>	<i>Assessment</i>	<i>Credits</i>
Required Subjects							
N409002	Chemical Engineering I	409	2	3	0	c,Ex	6
N402002	Analytical Chemistry I	402	2	1	0	c,Ex	4
N413004	Applied Statistics	413	1	2	0	c,Ex	4
N403013	Physical Chemistry: Laboratory I	403	0	0	4	c	3
N827004	Physical Education	827	0	2	0	c	0
Semi-elective Subjects 4 and 5							
N403014	Physical Chemistry II	403	3	2	0	c,Ex	7
N110003	Organic Chemistry: Laboratory II	110	0	0	4	c	3
N107004	Characterization Methods for Substances	107	2	2	0	c,Ex	5

N112003	Macromolecular Chemistry	112	2	1	0	c,Ex	4
N101008	Structure and Properties of Materials	101	2	1	0	c,Ex	4
N107001	Inorganic Non-Metallic Materials	107	2	0	0	Ex	3
N106018	Metallic Construction Materials	106	2	0	0	Ex	3
N126018	Applied Chemical Thermodynamics	126	2	1	0	c,Ex	4
N148002	Polymers for the Conservation of Historical Buildings	148	2	0	0	Ex	3
N148004	Materials of Historical Buildings	148	2	0	0	Ex	3
Elective Subjects							
	Elective Subject for 4th Semester						

Study Year: 3

Winter Semester

<i>Code</i>	<i>Required Subjects</i>	<i>Dep.</i>	<i>L</i>	<i>S</i>	<i>Lab</i>	<i>Assessment</i>	<i>Credits</i>
Required Subjects							
N409013	Chemical Engineering: Laboratory	409	0	0	3	c	2
N402503	Analytical Chemistry: Laboratory I	402	0	0	6	c	4
N409004	Chemical Engineering: Project	409	0	1	0	c	1
N111010	Data Acquisition and Data Treatment	111	1	2	0	c,Ex	4
N150013	Specialized Laboratory	150	0	0	6	c	4
Programm Semi-elective Subjects 1							
N111007	Raw Materials in Chemical Industry	111	2	1	0	c,Ex	4
N111005	Catalysis	111	2	1	0	c,Ex	4
N106003	Materials Corrosion	106	2	1	0	c,Ex	4
Semi-elective Subjects 6 and 7							
N409003	Chemical Engineering II	409	2	3	0	c,Ex	6
N402004	Analytical Chemistry II	402	2	1	0	c,Ex	4
N403012	Physical Chemistry: Laboratory II	403	0	0	3	c	2
N112004	Characterization Methods for Polymeric Materials	112	2	0	2	c,Ex	4
N101001	Safety Legislation in Chemistry	101	2	0	0	Ex	3
N107005	Technical Mineralogy	107	2	1	0	c,Ex	4
N112001	Physics of Polymers	112	2	1	0	c,Ex	4
N107006	Fundamentals of Glass and Ceramic Technologies	107	2	1	0	c,Ex	4
N106006	Properties and Testing of Metals	106	2	1	0	c,Ex	4
N126012	Introduction to Electronics	126	2	0	0	Ex	3
Elective Subjects							
	Elective Subject for 5th Semester						

Summer Semester

<i>Code</i>	<i>Required Subjects</i>	<i>Dep.</i>	<i>L</i>	<i>S</i>	<i>Lab</i>	<i>Assessment</i>	<i>Credits</i>
Required Subjects							
N963007	Bachelor work	963	0	0	8	SFE	10
Semi-elective Subjects 8							

N402007	Analytical Chemistry: Laboratory II	402	0	0	4	c	3
N111011	Fine Chemicals	111	2	1	0	c,Ex	4
N148050	Chemical and Physical Principles of Buildings Sanitation	148	2	0	0	Ex	3
N106004	Metallurgy	106	2	0	0	Ex	3
N107002	Automatic Control in Glass and Ceramics Industry	107	2	1	0	c,Ex	4
N126002	Materials for Electronics	126	2	1	0	c,Ex	4
N112006	Technology of Polymer Materials Processing	112	2	0	0	Ex	3
Elective Subjects							
	Elective Subject for 6th Semester						

Subject Title: General and Inorganic Chemistry I

Semester: 1st

Weekly Load and Assessment: 3/2/0 c, Ex

Credit: 8

Language: English

Course provider: Department of Inorganic Chemistry

Annotation:

1. Structure of atom, atomic orbitals and their occupation. Configuration of valence sphere.
2. Periodic law. Classification of elements. Vertical and horizontal similarities.
3. Chemical bond. Covalent and ionic bond, electronegativity, polarization force.
4. Stoichiometry of compounds of nontransition elements. Structural formulas and their utilization.
5. Hybridization of AO. Structure and properties of molecules nontransition elements.
6. Hydrogen, oxygen, bonding possibilities. Water, aqueous solutions, acids and bases.
7. Halogens, rare gases, bonding possibilities. Compounds of halogens, redox reactions.
8. Sulfur, bonding possibilities, important compounds. Factors influencing reaction path.
9. Nitrogen, bonding possibilities. Chemical equilibrium and kinetics. Compounds of nitrogen.
10. Phosphor. Compounds of phosphor, polyanions. The most important inorganic compounds.
11. Carbon, silicon and their compounds, bonding possibilities of elements of the 2-nd and higher periods.
12. Production of important metals, metal bond and properties of metals, metal corrosion.
13. Nontransition metals, bonding possibilities, group trends, diagonal relationship.
14. Transition metals, bonding possibilities, trends in groups and periods.

Subject Title: Mathematics I

Semester: 1st

Weekly Load and Assessment: 3/3 /0 c, Ex

Credit: 9

Language: English

Course provider: Department of Mathematics

Annotation:

15. Elements of Mathematical Logic. Introduction to calculus.
16. Continuity and limits of the functions of one and two variables.
17. Derivatives, Mean value theorem, L' Hospital's rule. Partial derivatives.
18. Monotone functions, extreme values of a function, asymptotes of the graph.
19. Newton's methods. Taylor's formula with remainder. Differential.
20. Curves in plane, tangent vector. Polar coordinates.
21. Indefinite integral. Definite integral. Applications in Geometry and Physics.
22. Techniques of integration.
23. Improper integrals. Numerical integration. The mean value theorem for integrals.
24. Ordinary differential equations of the first order. Separable equations.
25. Linear differential equations of the first order and their applications. Euler's method.
26. The space \mathbb{R}^n , geometry in \mathbb{R}^3 , vectors, dot and cross products.
27. Matrices and Determinants. Inverse matrix.
28. The systems of linear algebraic equations. Gauss-Jordan method. Cramer's rule.

Subject Title: Toxicology and Ecology

Semester: 1st

Weekly Load and Assessment: 2/0/0 Ex

Credit: 3

Language: English

Course provider: Department of Organic Technology

Annotation:

14. Toxicology, its scope and basic principles
15. Historical background of modern Toxicology
16. The most common inorganic, herbal, animal, microbiological and fungi poisons
17. Xenobiotics – classification
18. Xenobiotics and their interactions with a living body
19. Biochemical effects of xenobiotics
20. Modes of intercellular communications
21. Biotransformation processes
22. Most common organic poisons (e.g. drugs)
23. Materials Safety Data Sheets
24. Exposure limits and safety rules, law regulations
25. Ecotoxicology
26. Toxicology and chemical industry

Literature: Lecture notes, a special text is now being prepared

Subject Title: Application of Computer Science

Semester: 1st

Weekly Load and Assessment: 0/3/0 c

Credit: 3

Language: English

Course provider: Department of Computing and Control Engineering

Annotation:

15. Information technology, computer architecture, operational systems principles
16. Computer networks, Internet fundamentals, e-mail
17. Text editor fundamentals, basic functions, styles
18. Technical writing, formulas, equations and tables
19. Computer graphics fundamentals, formats, graphic object inserting
20. Spreadsheets, formulas and functions applications
21. Graphics in spreadsheets, worksheets, functions survey
22. Data transfer in spreadsheets and text editors, tables and graphs export
23. Technical applications of spreadsheets, data files processing
24. Database operations, data classification in spreadsheets, information filtering
25. File transfer, data import to spreadsheets, data export
26. Numeric and graphical processing of a real data in spreadsheets
27. Information systems integration, files administration
28. Student individual project using PC

Subject Title: Chemical Calculations

Semester: 1st

Weekly Load and Assessment: 0/2/0 c

Credit: 2

Language: English

Course provider: Department of Inorganic Chemistry

Annotation:

1. Basic physical properties and units. Composition of mixtures and compounds.
2. Preparation of solutions of pure and/or impure substances.
3. Preparation of solutions by dilution or by mixing of different solutions.
4. Stoichiometry calculations (including reactions of the ideal gas).
5. Stoichiometry calculations, reactions with an excess of reactants.
6. Preparation of solutions and stoichiometry calculations.
7. Saturated solutions, solution preparation by dissolving or concentrating.
8. Saturated solutions, disturbed crystallisation.
9. Recapitulation.
10. Test.
11. Recapitulation.
12. 1. Test reparation.
13. Recapitulation.
14. 2. Test reparation.

Subject Title: Enterprise Economics

Semester: 1st

Weekly Load and Assessment: 2/1/0 c, Ex

Credit: 4

Language: Czech, English

Course provider: Department of Economics and Management of Chemical and Food Industry, Ing. Milan R. Paták, CSc.

Annotation:

15. Enterprise as a economic subject, influence of state, tax system
16. Asset, Equity and Debt Classification
17. Structure of Assets, Evaluation of Assets, Depreciations, Turnover
18. Structure of Equity and Debts, Financial Resources
19. Cost and Revenues, Cash-Flow Statement
20. Classification of Costs, Break-Even Point
21. Enterprise - Subject of Market, Sales, Profit, Price
22. Cost and Output Costing, Costing Use, Division Costing
23. Non-absorption Costing, Specific Costing Algorithm in Chemical and Food Industry
24. Production process and its structure, type of production, relationship of production process at the time, material accuracy
25. Basic items of the production process, performance indicators, standards and their position, material and energy in the production process
26. Production equipment, extensive equipment utilization, maintenance systems, intensive equipment utilization, throughput capacity, performance diagram
27. Labour utilization in the production process, operating standards, productivity of labour
28. Feasibility studies, innovations

Literatures

Keat P.G., Young P.K.Y.: **Managerial Economics**, Upper Saddle River, New Jersey 2003, ISBN 0-13-035335-3

Mansfield E. et al: **Managerial Economics**, W.W.Norton&Company, New York 2002, ISBN 0-393-97677-7

Subject Title: Organic Chemistry I

Semester: 2nd

Weekly Load and Assessment: 3/2/0 c, Ex

Credit: 7

Language: English

Course provider: Department of Organic Chemistry

Annotation:

1. Introduction, main groups of organic compounds. Oxidation state.
2. Nomenclature of organic compounds – functional groups.
3. Shape of organic compounds – introduction to stereochemistry.
4. Alkanes, radical substitution, structure of free radicals.
5. Alkenes, addition reactions, structure and stability of carbocations.
6. Dienes, pericyclic reactions, alkynes.
7. Arenes, regioselectivity of electrophilic substitution, oxidation and reduction.
8. Haloderivatives, organometallic compounds, S_N .
9. Hydroxyderivatives, eliminations and rearrangements.
10. Organic derivatives with S, N, P functional groups.
11. Aldehydes and ketones. A_N .
12. Aldehydes and ketones – enolates and their reactions.
13. Carboxylic acids – mechanism esterification.
14. Derivatives of carboxylic acids.

Subject Title: Physics I

Semester: 2nd

Weekly Load and Assessment: 3/2/0 c, Ex

Credit: 7

Language: English

Course provider: Department of Physics and Measurements

Annotation:

15. Basic concepts of mechanics I: Force, the Newton's laws, work, power, kinetic and potential energy. Conservation of mechanical energy and linear momentum, elastic and inelastic collisions.
16. Basic concepts of mechanics II: Moment of inertia, torque, angular momentum. Work, power and energy in rotational motion. Rolling motion of rigid bodies. Static equilibrium conditions, center of gravity.
17. Introduction to the kinetic theory of gases: Kinetic interpretation of pressure and temperature. Average kinetic energy of molecules. Velocity distribution of molecules. Mean free path of a molecule.
18. Continuum and fluid mechanics: Forces in continuum, deformation, Hooke's law. Hydrostatic pressure, Archimedes' law. Bernoulli's equation, real liquid flow.
19. Oscillations: undamped, damped and forced harmonic oscillations. Composed oscillations.
20. Waves: description, propagation velocity, intensity. Huygens principle, refraction and reflection, Snell law. Interference, standing waves.
21. Electrostatic field: Coulomb's law. Electric dipole. Potential, voltage, work. Capacitor, dielectric polarization. Charge motion in an electric field.
22. Direct current circuits: Ohm's law, Joule law. Kirchhoff's rules. Current, voltage and resistance measurements.
23. Magnetic field: Magnetic force. Mass spectrograph, electric measurement instruments, cyclotron, the Hall effect. Biot-Savart law, Ampere's law. Magnetic fields in matter.
24. Electromagnetic field: electromagnetic induction, proper and mutual inductance. Electromagnetic waves, energy of electromagnetic field.
25. Alternating current circuits: Generator. Power. Impedance, phase shift, serial resonance circuit.
26. Wave optics: concept of light, interference, thin film, single-slit diffraction, diffraction grating, polarization, optical activity.
27. Geometric optics: Basic concepts, reflection and refraction, optical instruments: magnifying glass, microscope, telescope.
28. Basic concepts of modern physics: The photoelectric effect, X-rays, the particle-wave duality, absorption, emission, laser.

Subject Title: Inorganic Chemistry: Laboratory I

Semester: 2nd

Weekly Load and Assessment: 0/0/4 c

Credit: 3

Language: English

Course provider: Department of Inorganic Chemistry

Annotation:

1. Laboratory rules and safety, writing laboratory reports
2. Fundamental laboratory equipment
3. Basic laboratory works - dissolution, filtration, evaporation, precipitation, decantation
4. Fundamental laboratory operations - crystallization, weighing, density, pH
5. Oxidation - reduction reactions, procedure in solution and in solid state
6. Non-metal chemistry, reactions of non-metals and their compounds
7. Preparations of characteristic compounds of selected elements, mass balances
8. Important qualitative reactions of anions, determination of unknown samples
9. Metal chemistry - reaction of metals and their compounds
10. Preparations of characteristic metal compounds and their reaction
11. Coordination compounds of transition metals
12. Qualitative analysis of cations, separation and identification of unknown samples

Subject Title: Management of Enterprise Processes

Semester: 2nd

Weekly Load and Assessment: 2/1/0 c, Ex

Credit: 4

Language: Czech, English

Prerequisites: Enterprise Economics

Course provider: Hradecký

Annotation:

15. Corporate Management in Chemical and Food Industry
16. Decision-Making Information Support
17. Corporate Planning
18. Corporate Plans Structure
19. Marketing in Corporate Management
20. Distribution Management
21. Production Management
22. Purchase Management
23. Organization, Company Structure
24. Human Resources Management – Evaluation and Motivation
25. Time Management and Team Work
26. Safety and Quality Management
27. Environmental Management
28. Controlling and Auditing

Literature:

4. Samuelson W.F., Marks S.G. *Managerial Economics*. Lachina Publishing 2003. ISBN 0-470-00044-9.
5. Cole G.A. *Management, Theory and Practice*. DP Publications, Ltd. London 1990. ISBN 1 870941 90 X.
6. Weihrich H., Koontz H. *Management a Global Perspective*. Mc-Graw-Hill, Inc. 1993. ISBN 0-07-069170-3.

Subject Title: Mathematics II

Semester: 2nd

Weekly Load and Assessment: 3/3/0 c, Ex

Credit: 8

Language: Czech, English

Prerequisites: Mathematics I

Course provider: Department of Mathematics

Annotation:

1. Linear space, base, dimension. The space $C(I)$. Linear mapping.
2. Linear differential equations of n-th order.
3. The system two linear and nonlinear differential equations of the first order.
4. Predator-Prey models: Lotka-Wolterra System.
5. Geometry in \mathbb{R}^3 (\mathbb{R}^n). Metrics in \mathbb{R}^n .
6. Differential calculus in \mathbb{R}^n . The functions of two and more variables.
7. Directional and partial derivatives. Tangent plane. Gradient. Newton's method.
8. Taylor's formula. The Hessian and extreme values. Method of least squares.
9. Implicit function theory.
10. Line integral of scalar and vector field.
11. Differential form, exact differential form, Potential vector field.
12. Line integrals independent of the path.
13. Double integrals. Fubini theorem, Substitution in double integral. Improper integrals.
14. Triple integrals. Applications. Cylindrical and spherical coordinates.

Subject Title: General and Inorganic Chemistry II

Semester: 2nd

Weekly Load and Assessment: 2/2/0 c,Ex

Credit: 5

Language: English

Course provider: Department of Inorganic Chemistry

Annotation:

1. Atomic orbitals. 3d/4s problem. Molecular orbitals.
2. Periodic law. Vertical and horizontal similarities. p-,d-, a f- contraction.
3. Symmetry of molecules. Hybridization for lowered symmetry cases.
4. Hydrogen, hydrogen bonding, hydrides. Van der Waals interactions and noble gases.
5. Oxygen. Lewis theory of acids and bases. Oxide acidity. Ozone. Peroxides.
6. Halides. Stability of oxidation states. Redox potentials.
7. 16th group – from nonmetals to metals. Homo- and heterocatenating.
8. Nitrogen and phosphorus. Bonding characteristics of the 2nd and lower period elements.
9. Carbon, silicon, boron. Single, multiple and multicentered bonds.
10. Chemical bonding in solids and their properties. Metals, semiconductors, insulators.
11. Principles of crystal chemistry. Structure types.
12. Coordination compounds. Geometrical and optical isomerism. Symmetry.
13. Bonding and properties of coordination compounds. Organometallic compounds.
14. Influence of inert pair and lanthanide contraction on the chemical properties of metals.

Literature: G. E. Rogers, Descriptive Inorganic, Coordination, and Solid State Chemistry, 2nd Ed., Thomson Learning, 2002.

Subject Title: Law Basics

Semester: 2nd

Weekly Load and Assessment: 2/0/0 Ex

Credit: 3

Language: English

Course provider: Department of Social Sciences

Annotation:

14. Private law relations
15. Real rights
16. Law of obligations
17. Civil relations/ Civil law relations
18. Contracts according to Civil Code
19. Entities of business activity
20. Commercial obligations
21. Contracts according to Business Code
22. Housing law
23. Family law
24. Law of succession
25. Judicial proceedings
26. Labor law

Literature:

Civil Substantive Law, vol. I and II, 2nd edit. Codex, Praha 1997,
2nd edit. Codex Bohemie, Praha 1997

Subject Title: Human Resources Management

Semester: 2nd

Weekly Load and Assessment: 2/1/0 c, Ex

Credit: 4

Language: English

Course provider: Department of

Annotation:

15. Fundamental Concepts of Human Ressource Management
16. Human Ressource Planning
17. Job Analysis and Job Design
18. Recruitment, Selection Process
19. Performance Appraisal and Feedback
20. Reward Systems
21. Work Motivation
22. Career Planning and Development
23. Organizational Culture
24. Internal and External Communication Process
25. Work Team
26. Work Stress
27. Approaches to Organization Change
28. Stimulating Organizational Creativity and Cooperative Behavior

Subject Title: Fundamentals of Physics: Repetition

Semester: 2nd

Weekly Load and Assessment: 0/2/0

Credit: 0

Language: English

Course provider: Department of Physics and Measurements

Annotation:

1. Physical quantities, units, changing units
2. Vector calculus
3. Kinematics of motion along a straight line or a curve
4. Dynamics of motion along a straight line
5. Dynamics of motion along a curve
6. Work, power, efficiency, mechanical energy
7. Motion in a gravitational field
8. Rigid body statics
9. Rigid body motion
10. Archimedes' law, hydrostatic pressure
11. Ideal liquid flow
12. Basic problems of geometric optics
13. Basic problems of direct current circuits
14. Basic problems of alternating current circuits

Subject Title: Physical Chemistry I

Semester: 3rd

Weekly Load and Assessment: 3/2/0 c, Ex

Credit: 7

Language: English

Course provider: Department of Physical Chemistry

Annotation:

1. Basic terminology, thermodynamic system, thermodynamic process, state properties.
2. State behaviour of gases, equation of state of ideal gas. Real gas and its behaviour.
3. 1st law of thermodynamics. Internal energy, heat, work.
4. Enthalpy, heat of reaction, standard enthalpy of formation. Hess and Kirchhoff's laws.
5. 2nd law of thermodynamics, entropy. Entropy changes on selected processes.
6. Helmholtz and Gibbs energy, their significance. 3rd law of thermodynamics.
7. Partial molar quantities, activity, chemical potential, standard states.
8. Material balance of chemical reactions. Equilibrium constant. Equilibria in electrolyte systems.
9. Chemical equilibria of reactions in gaseous phase.
10. Galvanic cells, symbols, usage, Nernst equation.
11. Basic terminology of chemical kinetics, reaction rate, integration of rate equations.
12. Phase equilibria in single-component systems, Clapeyron equation.
13. Gibbs phase law, vapour-liquid equilibrium in ideal systems, phase diagrams.
14. Solubility of gases in liquids, equilibria in condensed systems.

Reading

- Novák J. a kol.: Fyzikální chemie – bakalářský kurz , VŠCHT Praha 2005 (in Czech)
- Novák J. a kol.: Fyzikální chemie II , VŠCHT Praha 2001 (in Czech)
- Atkins P.W.: Physical Chemistry , Oxford University Press 1998 (in English)
- Malijeviský a kol.: Physical Chemistry in Brief, VŠCHT Praha 2005, available in English on the Internet (Web pages of the Department of Physical Chemistry)

Subject Title: Biochemistry I

Semester: 3rd

Weekly Load and Assessment: 3/0/0 Ex

Credit: 5

Language: English

Course provider: Department of Biochemistry and Microbiology

Annotation:

1. Living systems, their composition and organisation.
2. Aminoacids (properties, reactions, determination) and peptides.
3. Proteins (relation between structure and function).
4. Enzymes: structure, nomenclature, classification.
5. Reaction kinetics of enzyme reactions, regulation of enzyme actions.
6. Chemistry of nucleotides and nucleic acids, replication.
7. Transcription, translation, posttranslational modifications.
8. Chemistry of lipids. Biomembranes and membrane transport.
9. Principles of metabolism. Bioenergetics.
10. Aerobic and anaerobic respiration, light reactions of photosynthesis.
11. Citric acid cycle and glyoxylate cycle.
12. Chemistry of carbohydrates. Carbohydrate metabolism I.
13. Carbohydrate metabolism II. Lipid metabolism.
14. Metabolism of proteins and nucleic acids.

Subject Title: Organic Chemistry: Laboratory I

Semester: 3rd

Weekly Load and Assessment: 0/0/4 c

Credit: 3

Language: English

Course provider: Department of Organic Chemistry

Annotation:

1. Introduction to the laboratory course, safety rules. Demonstration of assembly of chemical apparatus and basic operations of organic synthesis.
2. A selection of one- and two-step syntheses of organic compounds. Separation and identification of products using both classical and modern instrumental means. Practical use of crystallization, filtration and suction filtration.
3. Heating under reflux condenser with magnetic stirring.
4. Distillation under atmospheric and reduced pressure.
5. Water steam distillation.
6. Melting point determination, GLC and TLC chromatography of prepared compounds.

Literature

1. Laboratory manuals in English are available for students at the beginning of the laboratory course.
2. Hudlický M : Laboratory Experiments in Organic Chemistry. Virginia Polytechnic Institute and State University, Avery Publishing Group Inc., Wayne, N.J. 1990.
3. Vogel A.I.: Vogel's Textbook of Practical Organic Chemistry Longman Scientific and and Technical, Essex, England, 5th ed., 1994.

Subject Title: Physics: Laboratory

Semester: 3rd

Weekly Load and Assessment: 0/0/3 c

Credit: 2

Language: English

Course provider: Department of Physics and Measurements

Annotation:

1. Introduction
2. Measurement of length and time. Regulation of voltage and current.
3. Weighing on analytical scale and measurement of density.
4. Measuring of viscosity.
5. Measuring of the moment of inertia from time of swing.
6. Measuring of sound propagation speed in gases.
7. Laser radiation and study of diffraction effect. Measuring of focal length of thin lenses.
8. Optical methods in measuring of concentration of matter in solution. Polarimetry, refractometry.
9. Resistors. Transition of measuring instruments range. Compensating measuring method.
10. Measurement of inductivity and capacity.
11. Asynchronous motor. Power and turns regulation.
12. Measurement of transistor amplifier. Voltage stabilization.
13. Detection of ionizing radiation. Measurement of Planck's constant.
14. Measurement of magnetic field. Proof of the Biot-Savart law. Relating magnetic force and field.

Subject Title: Chemical informatics

Semester: 3rd

Weekly Load and Assessment: 0/2/0 c

Credit: 2

Language: English

Name of lecturer: Ing. Jaroslav Šilhánek, CSc

Ing. Petr Kačer, PhD

Course provider: Department of Physics and Measurements

Objective of the course (expected learning outcomes and competences to be acquired)

Students will get overall understanding of basic principles of communication of scientific knowledge, their distribution, archiving and searching. The aim of the course is to provide students with practical skill in working with information based on standard principles and structures with modern information technologies

Prerequisites

Basic skill in using computers and network communication is expected

Course contents

15. Information as physical and social concept and its specific meaning in science.
16. Mechanism of distribution, storage, and searching of scientific information
17. Analysis, classification and indexing of scientific publications
18. Modern information technologies and their impact on work-up of scientific publication.
19. Concept of scientific databases, different types, structures and usage.
20. General strategy of databases usage, technical and economic aspects.
21. Specific situation in chemistry and some other branches of natural science.
22. Libraries, their organization and usage in past and in present times.
23. Chemical Abstracts as fundamental and indispensable information source for all chemistry disciplines.
24. Chemical compound and its structure as key element of chemical information.
25. Representation of chemical structures in digital form, structure and reaction databases.
26. Patent as specific form of technical and scientific information, patent databases and other aspects of patent information.
27. Toxicological, environmental, biotechnological and other kind of information related to chemistry.
28. Assessment of present situation in chemical information and its perspectives

Recommended reading

Jaroslav Šilhánek: Chemická informatika, Praha 2002.

Jaroslav Šilhánek: Science Citation Index – Web of Science, Praha 2000.

Jaroslav Šilhánek, Ludmila Zetková: Chemical Abstracts on CD-ROM. Praha 1997.

Robert E. Maizell: How to find Chemical Information, J.Wiley 1998.

Damon Ridley: Information Retrieval. SciFinder® and SciFinder® Scholar, J.Wiley 2002.

Johann Gasteiger, Thomas Engel: Chemoinformatics, A Textbook,
J.Wiley-VCH 2003.

Teaching methods

Seminars

Assessment methods

Oral/written examination/practical work

Language of instruction

Czech/English

Subject Title: Fundamentals of Chemical Technologies

Semester: 3rd

Weekly Load and Assessment: 2/0/0 Ex

Credit: 3

Language: English

Course provider: Department of Inorganic Technology

Annotation:

15. Chemical reaction in the technology processes
16. Hydrogen and ammonia production
17. Nitric acid, sulphur acid
18. One-component industrial fertilizers
19. Multi-component industrial fertilizers
20. Sodium hydroxide and chlorine production
21. Steel and aluminium production
22. Raw material base of organic productions, renewable resources
23. Coal, natural gas, C1 chemistry
24. Crude oil and its refinery treatment
25. Petrochemistry
26. Hydrogenation and dehydrogenation
27. Esterification and hydrolysis
28. Acid catalysed reactions

Subject Title: Introduction to Study of Materials

Semester: 3rd

Weekly Load and Assessment: 2/0/0 Ex

Credit: 3

Language: English

Course provider: Department of Solid State Chemistry

Annotation:

1. Materials – definition, classification; history of materials
2. Chemical bond and internal structure of materials
3. Functional properties of materials (mechanical, electrical, magnetic, optical, thermal)
4. Ceramics
5. Glass
6. Polymers – preparation, structure, properties
7. Plastics, rubber, resin
8. Conductors, semiconductors, insulators, superconductors
9. Optical and magnetic materials
10. Iron and ferrous alloys
11. Nonferrous metals and alloys
12. Building materials
13. Composite materials
14. Degradation of materials

Subject Title: Organic Chemistry II

Semester: 3rd

Weekly Load and Assessment: 2/1/0 c, Ex

Credit: 4

Language: English

Course provider: Department of Organic Chemistry

Annotation:

1. Saccharides – monosaccharides, their structure, stereochemistry, and reactions.
2. Oligo – and polysaccharides.
3. Halogen- , hydroxy- , and unsaturated carboxylic acids.
4. Amino acids, peptides , primary structure.
5. Oxo acids and their synthetic utilisation.
6. Heterocycles.
7. Chemistry of nucleosides, nucleotides and NA.
8. Organic synthesis – methods for alkanes, alkenes, alkynes.
9. Synthetic procedures for monofunctional compounds.
10. Synthesis of aldehydes, ketones and carboxylic acids.
11. Synthesis of functionalized carboxylic acids.
12. Synthesis of heterocycles.
13. Natural products.
14. Methods used for structure determination.

Subject Title: Physics II

Semester: 3rd

Weekly Load and Assessment: 2/2/0 c, Ex

Credit: 5

Language: English

Course provider: Department of Physics and Measurements

Annotation:

1. Electromagnetic field: Maxwell's equations, electromagnetic waves (properties, energy transfer, intensity, polarization).
2. Special relativity: principles, the Lorentz transformation, length contraction, time dilation, velocity transformations. Relativistic dynamic quantities. The mass-energy equivalence.
3. Introduction to quantum physics: Blackbody radiation, the Stefan-Boltzmann law, spectral intensity distributions, the Planck distribution law. Absorption and emission. Laser.
4. Electrons and photons: The photoelectric effect, threshold wavelength and frequency, stopping potential. The Compton effect, X rays, X ray diffraction by a crystal.
5. Wave nature of particles: De Broglie wavelength, electron diffraction by a crystal lattice, electron microscope. The particle-wave duality, the uncertainty principle.
6. Basics of quantum mechanics: wave function and its properties, the probability density. Operators: eigenvalue equations and eigenvalues. The Schroedinger equation.
7. Quantum mechanical solution of simple problems I: Free particle, particle in an infinite square well, energy spectrum, degeneracy.
8. Quantum mechanical solution of simple problems II: Tunnel effect, the harmonic oscillator, energy spectrum of the linear harmonic oscillator. The correspondence principle.
9. The hydrogen atom: particle in a Coulomb potential, energy levels, the atomic spectrum. Quantum numbers of the hydrogen atom, the radial probability density.
10. Quantum mechanical solution of the hydrogen and hydrogen-like atoms: Contour diagrams. The Zeeman effect. Spin of the electron, fine structure of energy levels, spin-orbit interaction.
11. Many-electron atoms: The orbital approximation, effective charge of a nucleus, screening. The building-up principle, the Hund rule, the Pauli exclusion principle.
12. Introduction to solid state physics: Band structure of energy levels of solids. The Fermi-Dirac distribution, the Fermi energy. Intrinsic and extrinsic semiconductors, p-n junction.
13. Applications of the p-n junctions: Diodes, semiconductor rectifiers, transistor amplifiers, thyristors, integrated circuits.
14. Introduction to nuclear physics: Selected properties of atomic nuclei, radioactive decay, radioactivity, measurement of the dose rate. Model of the nuclear fission, nuclear reactor.

Subject Title: Fundamentals of Marketing Chemical Products

Semester: 3rd

Weekly Load and Assessment: 2/0/0 Ex

Credit: 3

Language: English

Course provider: Doc.Ing. Stanislava Grosová, CSc.

Annotation:

16. The role of marketing in organizations. Marketing management. Marketing strategy
17. Marketing environment – customers, competitors, trends in macroenvironment.
18. Consumer and Industrial markets. Industrial Buying Process.
19. Market segmentation and product positioning.
20. Brand management.
21. Product – quality, packaging, application services
22. New product development and market introduction
23. Price and pricing.
24. Distribution channels
25. Marketing communication. Public relations. Sales promotion.
26. Personal selling.
27. Sales force management.
28. Key account management.
29. Sales promotion. Public relations. Direct marketing.
30. Market intelligence.

Subject Title: User Software

Semester: 3rd

Weekly Load and Assessment: 0/3/0 c

Credit: 3

Language: English

Course provider: Department of Organic Technology

Annotation:

1. Operation and network systems: Windows, Novell, managers, configuration, access rights, networks
2. Text processor (MS Word) – advanced methods of text processing, using and handling styles, equations, templates
3. Text processor – advanced techniques: objects, graph and data import, lists, indexes, long documents
4. Spreadsheet (MS Excel) – revision, basic knowledge broadening, space blocks, files interlinking – work with several files
5. Spreadsheet – graph possibilities, mathematical calculations, systems of equations, solver
6. Spreadsheet – data handling and analysis, statistical calculations
7. Spreadsheet – data import, export and handling, databases in Excel, advanced techniques, macros
8. Matlab – integrated user environment - basics
9. Matlab – calculations and graphics
10. Matlab – programming and library utilization
11. Matlab – data sharing and applications
12. Results presentation in electronic form – MS PowerPoint – basics
13. MS PowerPoint – animation, sounds linking; electronic mail, Outlook
14. Credit test – individual problem solving

Subject Title: Inorganic chemistry: Laboratory II

Semester: 3rd

Weekly Load and Assessment: 0/0/4 c

Credit: 3

Language: English

Course provider: Department of Inorganic Chemistry

Annotation:

1. Chemistry of non-transition and transition metals
2. Preparation of metals and compounds by different technique -melting, precipitation
3. Mass balance of chemical reactions
4. Oxidation - reduction reactions of metal compounds
5. Preparation of coordination compounds
6. Ion exchange chromatography
7. Wasteless technology - preparation series
8. Analytical important reactions of metal cations
9. Qualitative determination of metal cations in unknown samples

Subject Title: Chemical Engineering I

Semester: 4th

Weekly Load and Assessment: 2/3 /0 c, Ex

Credit: 6

Language: English

Course provider: Department of Chemical Engineering

Annotation:

1. Basic concepts. Classification of systems. Fundamentals of balances. Balances of mass and molar amount.
2. Balances of energy, enthalpy and momentum. Bernoulli equation and equation of hydrostatics.
3. Flow of fluids through pipelines. Transport of fluids, pumps. Flow of fluids through the layer of granular material.
4. Filtration, types of filters, rate of filtration. Sedimentation, sedimentation velocity, sedimentation equipment.
5. Fluidization, fluidization equipment, description of fluidized bed reactor. Mixing, mixing equipment. Residence time.
6. Heat transfer by conduction, convection and radiation. Local and overall heat transfer. Heat transfer coefficients.
7. Heat exchangers: types of equipment and calculation of different types. Evaporators: types of equipment, balances. Crystallization.
8. Diffusion separation processes. Separators. Equilibrium stage.
9. Membrane separation processes, types of membranes and modules, driving forces, calculations of membrane modules.
10. Liquid-liquid extraction, extractors. One step, repeated and counter-current extraction.
11. Equilibrium and differential distillation of binary mixtures. Rectification of binary mixtures.
12. Absorption, types of absorbers, number of equilibrium stages, height of packed absorption column. Adsorption.
13. Drying of solids, enthalpy diagram of wet air, batch and continuous dryers.
14. Chemical reactors and bioreactors, basic types. Molar and enthalpy balances.

Subject Title: Analytical Chemistry I

Semester: 4th

Weekly Load and Assessment: 2/1/0 c, Ex

Credit: 4

Language: English

Course provider: Department of Analytical Chemistry

Annotation:

1. Analytical chemistry, its functions and applications
2. Solution equilibria, pH
3. Titrimetry, gravimetry
4. Electrochemical methods
5. Extraction, principles of chromatography
6. Principles of chromatography, gas chromatography
7. Liquid chromatography, capillary electrophoresis and electrochromatography
8. Principles, spectrometric instrumentation
9. Atomic spectrometry
10. Molecular spectrometry
11. Molecular spectrometry
12. Mass spectrometry, combined techniques
13. Thermogravimetry, sensors, automated procedures
14. Errors in analytical measurements Errors in analytical measurements

Subject Title: Applied Statistic

Semester: 4th

Weekly Load and Assessment: 1/2/0 c, Ex

Credit: 4

Language: English

Course provider: Department of Mathematics

Annotation:

1. Events and random experiment. Probability, calculus of events probability, combinatorial formulas. Conditional probability, independent events Bayes's theorem.
2. Random variable, distribution of random variable. Distribution function definition and properties. Probability function and probability density.
3. Mean, variance, quartiles (quartiles, percentiles). Simple functions of random variable.
4. Multivariable random variables. Independence and Correlation of random variables. Covariance and correlation matrix.
5. Basic types of discrete probability distribution application examples.
6. Basic types of continuous probability distributions Normal (Gaussian) distribution, Log-normal distribution, Student t- distribution, F-distribution. Tables of distribution quantiles and manipulation with them.
7. Random sample, sample space, sample estimator of distribution parameters, sorted sample, histograms. Random sample of Normal distributions.
8. The point estimators of unknown distribution parameters. Interval estimation and basic principle of setting it up.
9. Testing a Statistical Hypothesis. Null and Alternative Hypothesis, testing criterion, Errors of I. and II. type, probability level of test p-value. One-sample tests
10. Two-sample testing. Circumstances and fitness of using in different situations.
11. The confirmation of actual type of distribution (particularly Normal distribution). Goodness of Fit test condition of using, examples.
12. Evaluation of mutual dependency of random variables. Independency test. Analysis of contingency table, examples.
13. Regression analysis, linear regression model. Point and interval estimation of regression curve parameters. Tests of this parameters, prediction and variability region of regression curve. Application examples.
14. Complementary and statistical methods concluding lecture.

Literature:

1. Pavlik J. at all : Sbirka příkladu z pravděpodobnosti a matematické statistiky. VŠCHT Prague, 1999. (in Czech)
2. Freund J.E., Walpole R.E.: Mathematical Statistics. III. ed. Prentice Hall Inc. Englewood Cliffs New Jersey 07632.

Subject Title: Physical Chemistry: Laboratory I

Semester: 4th

Weekly Load and Assessment: 0/0/4, c

Credit: 3

Language: English

Course provider: Department of Physical Chemistry

Annotation:

11. Calorimetry I - heat of solution of inorganic salts
12. Kinetics of first-order reaction
13. Ideal-gas equation of state - determination of molar mass by V. Meyer's method
14. Colligative properties I – boiling point elevation
15. Colligative properties II – freezing point depression
16. One-component phase equilibrium - saturated vapour pressure of liquids
17. Phase diagrams of two-components condensed system – solid–liquid equilibrium
18. Phase diagram of three-components condensed system – liquid–liquid equilibrium
19. Conductivity of electrolytes - solubility product, infinite-dilution molar conductivity
20. Temperature dependence of solubility of salts

Subject Title: Physical Chemistry II

Semester: 4th

Weekly Load and Assessment: 3/2/0 c, Ex

Credit: 7

Language: English

Course provider: Department of Physical Chemistry

Annotation:

1. Real behaviour of gases, liquids and their mixtures (virial and multiconstant equations of state, CS theory).
2. Application of the 1st law of thermodynamics, temperature and pressure dependence of state functions.
3. Consequences of the 2nd law of thermodynamics, efficiency of heat engines, heat pumps.
4. Irreversible processes, Joule-Thomson coefficient, inversion temperature, condensation of gases.
5. Energetics of chemical reactions, reaction heat and methods for its determination.
6. Spontaneous changes and Gibbs energy. Chemical equilibrium in real systems.
7. Yield of chemical reaction, decompositions of solid substances, simultaneous equilibria.
8. Theory of electrolytic dissociation, equilibria in electrolyte solutions, pH, solubility constants.
9. Equilibrium electrochemical cells, classification, cells as energy sources.
10. Phase equilibria in real binary systems (l-g, l-l, s-l). Colligative properties.
11. Ternary systems, Nernst distribution law, phenomena on phase boundaries.
12. Diffusion, migration of ions in electric field, conductivity, Kohlrausch law.
13. Kinetics of simultaneous reactions, reversible reactions and chemical equilibrium.
14. Mechanism of chemical reactions, photochemistry, catalysis.

Subject Title: Organic Chemistry: Laboratory II

Semester: 4 th

Weekly Load and Assessment: 0/0/4 c

Credit: 3

Language: English

Course provider: Department of Organic Chemistry

Annotation:

1. The two- and multi-step syntheses of exact organic compounds which covers:
2. Improvement of students' skills in laboratory techniques obtained in the Organic Chemistry Laboratory I
3. Separation of mixtures on solid layers
4. Analysis of mixtures on solid layers
5. Syntheses of selected compounds according to Organic Synthesis
6. Syntheses adapted to semi-micro and micro scale operations

Literature:

1. Laboratory manuals in English are available for students at the beginning of the laboratory course.
2. Hudlický M : Laboratory Experiments in Organic Chemistry. Virginia Polytechnic Institute and State University, Avery Publishing Group Inc., Wayne, N.J. 1990.
3. Vogel A.I.: Vogel's Textbook of Practical Organic Chemistry Longman Scientific and and Technical, Essex, England, 5th ed., 1994.

Subject Title: Characterization Methods for Substances

Semester: 4th

Weekly Load and Assessment: 2/2/0 c,Ex

Credit: 5

Language: English

Course provider: Department of Glass and Ceramics

Annotation:

1. Description of radiation and particles.
2. Characterization of atoms, molecules, and solid state.
3. Spectrum - its origin and substance. Interactions between a particle and solid state.
4. X-ray spectral analysis.
5. Scanning electron microscopy.
6. Electron transmission microscopy.
7. Electron probe microanalysis.
8. Ion mass spectroscopy.
9. Structure and properties of the surface.
10. Methods for the characterization of the surface.
11. LEED, RBS, IIS, and AES.
12. X-ray photoelectron spectroscopy.
13. Scanning probe microscopy.
14. Synchrotron radiation. EXAFS, ELNES, EXELFS, XANES.

Subject Title: Macromolecular Chemistry

Semester: 4th

Weekly Load and Assessment: 2/1/0 c, Ex

Credit: 4

Language: English

Course provider: Department of Polymers

Annotation:

1. Introduction and historical development, nomenclature of polymers.
2. Structure of macromolecules, molecular weight.
3. Molecular structure and properties of polymers.
4. Polymerizability of low molecular substances.
5. Free radical polymerization – elemental reactions.
6. Kinetics of free radical polymerization.
7. Free radical copolymerization.
8. Ionic polymerization and copolymerization.
9. Insertion polymerization, polymerization practice.
10. Ring-opening polymerization.
11. Step-growth polymerization – characterization, reactivity of monomer functional groups.
12. Polycondensation - mechanism and kinetics, molecular weight distributions.
13. Polyadditions - typical syntheses.
14. Reactions of polymers.

Subject Title: Structure and Properties of Materials

Semester: 4th

Weekly Load and Assessment: 2/1/0 c, Ex

Credit: 4

Language: English

Course provider: Department of Inorganic Chemistry

Assoc. Prof. V. Flemr

Assoc. Prof. D. Sedmidubský

Annotation:

1. Electronic structure of inorganic materials
2. Bonding in solid state, bonding types and models
3. Atomic structure of inorganic materials
4. Factors which influence coordination of atoms in solid state
5. Crystal defects, non-crystalline materials
6. Mechanical properties, the role of bonding and atomic structure
7. Strong, hard and refractory materials. Composites
8. Electrical properties, the role of bonding and atomic structure
9. Conductors, superconductors, semiconductors insulators
10. Magnetic properties, the role of bonding and atomic structure
11. Ferromagnets, ferrimagnets. Hard and soft magnetic materials
12. Optical properties, the role of bonding and atomic structure
13. Luminiscence, phosphors, lasers, optoelectronic materials
14. Driving forces and mechanisms of chemical changes in materials

Subject Title: Inorganic Non-Metallic Materials

Semester: 4th

Weekly Load and Assessment: 2/0/0 Ex

Credit: 3

Language: English

Course provider: Department of Glass and Ceramics

Annotation:

1. Basic characteristics and types of inorganic materials
2. Physical-chemical principles of technological processes
3. Structure, phase composition and properties of ceramic materials
4. Fundamentals of technology and principal types of ceramic materials
5. New ceramic materials
6. Vitreous state – thermodynamic and kinetic aspects, structure models
7. Basic production processes and glass processing
8. Principal types of inorganic glasses
9. New inorganic glasses
10. Glass-ceramic materials – principles of production, types and properties
11. Inorganic non-metallic biomaterials
12. Vitreous and crystalline coatings
13. Inorganic binding materials
14. Monocrystalline materials

Subject Title: Metallic Construction Materials

Semester: 4th

Weekly Load and Assessment: 2/0/0 Ex

Credit: 3

Language: English

Course provider: Department of Metals and Corrosion Engineering

Annotation:

1. Structure of metals, structural defects, physical properties of metals
2. Mechanical properties of metals
3. Crystallization of metals
4. Phase diagrams
5. Fe-C phase diagram
6. Heat treatment of steels
7. Carbon steels
8. Alloy steels
9. Stainless steels
10. Cast irons
11. Properties and use of aluminium and its alloys
12. Copper alloys, low-melting metals and alloys
13. Nickel, cobalt, magnesium and titanium alloys
14. Precious metals

Subject Title: Applied Chemical Thermodynamics

Semester: 4th

Weekly Load and Assessment: 2/1/0 c, Ex

Credit: 4

Language: English

Course provider: Department of Solid State Engineering

Annotation:

1. p-V-T relationships of solids
2. Basic thermodynamic functions of solids , T and p dependencies
3. Heat of reaction, heat balance, Gibbs energy of reaction, equilibrium constant
4. Phase equilibria in one-component systems, polymorphism
5. The Clapeyron and Clausius-Clapeyron equations,
6. Behaviour of solutions, the Raoult's law
7. Dilute solutions, the Henry's law
8. Non-ideal solutions, regular solution model
9. Equilibria of solid-solid and gas-solid reactions, the Ellingham's diagrams
10. Equilibria of solid-liquid reactions, solubility product, equilibria of gas-liquid reactions, dissolution of gases
11. Equilibria in liquid solutions, complexes formation, stability constant
12. Phase equilibria in two-component systems
13. Binary phase diagrams
14. Electrochemical work, electrochemical potential, galvanic cells

Subject Title: Polymers for the Conservation of Historical Buildings

Semester: 4th

Weekly Load and Assessment: 2/0/0 Ex

Credit: 3

Language: English

Course provider: Department of Chemical Technology of Monument Conservation

Annotation:

1. Chemical and physical properties of polymers – basic notions
2. Dependence of polymers physical and mechanical properties on temperature
3. Solubility of polymers, viscosity and rheology of polymer solutions
4. Water dispersion and their properties
5. Polymers used for monuments conservation and their properties
6. Polymers used for monuments conservation and their properties
7. Polymers used for monuments conservation and their properties
8. Adhesion and adhesives, theory
9. Sizing materials and bonding cement
10. Technology of sticking
11. Paints – basic notions, definitions
12. Composition of paints, type of paints and their properties
13. Applications technology of paints
14. Helping matters – solvents, thinners, coalescent agents, pigments, filler and biocides

Literatura

Brydson J.: *Plastics Materials*, Butterworth 1999.

Oosten T.: *Plastics in Art*, Siegl 2002.

Subject Title: Materials of Historical Buildings

Semester: 4th

Weekly Load and Assessment: 2/0/0 Ex

Credit: 3

Language: English

Course provider: Department of Chemical Technology of Monument Conservation

Annotation:

1. Stone – origin, structure, properties, degradation processes.
2. Conservation of stone – agents and techniques.
3. Building binders - structure, properties, degradation processes.
4. Building materials - structure, properties, degradation processes.
5. Glass, ceramic and porcelain - structure, properties, degradation, conservation.
6. Metals - structure, properties, corrosion.
7. Conservation of metals objects - materials and techniques.
8. Natural binding materials - structure, properties.
9. Pigments – chemical composition, structure and properties.
10. Paper - structure, properties, degradation, conservation.
11. Parchment and leather - structure, properties, degradation, conservation.
12. Wood - structure and properties.
13. Conservation of wood – agents and techniques.
14. Textile - structure, properties, degradation processes.

Subject Title: Chemical Engineering: Laboratory

Semester: 5th

Weekly Load and Assessment: 0/0/3 c

Credit: 2

Language: English

Course provider: Department of Chemical Engineering

Annotation:

1. Groups of (usually) 3 students will obtain practical experience with unit
2. operations and equipment used in chemical manufacturing and food processing.
3. The group is assigned to make the prescribed measurements, to process the
4. experimental data and to elaborate the written report containing the measured results.
5. The written report also has to contain the conclusions.
6. List of assigned measurements:
7. Hydromechanical operations: Loss of mechanical energy during the fluid flow,
8. Characteristics of the centrifugal pump, Power input of the mixer, Filtration,
9. Sedimentation, Pressure drop during the fluid flow through the packed column.
10. Mechanical processes: Ball mill.
11. Heat transfer processes: Heat exchanger “tube in tube”. Heat transfer coefficient on
12. ribbed heat-exchange surface.
13. Separation processes: Rectification, Absorption, Drying, Reverse Osmosis.
14. Reactor engineering: Measurement of residence time distribution in flow-through vessel.

Subject Title: Analytical Chemistry: Laboratory I

Semester: 5th

Weekly Load and Assessment: 0/0/6 c

Credit: 4

Language: English

Course provider: Department of Analytical Chemistry

Annotation:

1. Gravimetry, complex-formation titrations with EDTA
2. Fluoride ion selective electrode
3. Potentiometric titration
4. Infrared spectrometry
5. Liquid chromatography
6. Coulometry
7. Spectrophotometry

Subject Title: Chemical Engineering: Project

Semester: 5th

Weekly Load and Assessment: 0/1/0 c

Credit: 1

Language: English

Course provider: Department of Chemical Engineering

Annotation:

1. Application of chemical engineering on more difficult problems, e.g. problems that include several unit operations or problems that require non-standard approaches, is the main aim of the course. The solved tasks should simulate real situations that appear in industry. A group of students (usually three-person) independently solves the assigned problems. It can help students to learn the principle of the team work. The students can consult the progress with a teacher. The solved problems demand a complex analysis, selection of a suitable method, bibliographic and/or technical search, and solution of the problems. Students prepare a written report that includes a scheme of the relevant chemical engineering operations, description of the used procedure for solution of the problem, solution of the problem, relevant tables and graphs, and bibliographic citations. The results of the work are defended in discussion with the teacher.

Subject Title: Data Acquisition and Data Treatment

Semester: 5th

Weekly Load and Assessment: 1/2/0 c,Ex

Credit: 4

Language: English

Course provider: Department of Organic Technology

Annotation:

15. Measurements in technical practice - objectives, design and evaluation, documentation.
16. Properties of industrial and laboratory data.
17. Measurements of basic quantities, systems of units, dimensions.
18. Estimation of physicochemical data, data sources in chemical informatics.
19. Data acquisition from mathematical models of chemical processes.
20. Simulation programs of chemical processes.
21. Statistical data handling, examples.
22. Statistical data analysis software, data plotting.
23. Data acquisition by means of mathematical models, principles of modelling.
24. Mechanistic model building, characteristics, practical utilisation.
25. Empirical model selection, characteristics, practical utilisation.
26. Parameter estimation methods, non-linear, multivariable and multiresponse regression, software.
27. Evaluation of regression analysis quality, reliability of regression parameters.
28. Experimental design for regression.

Literature

1. Box G. E. P., Hunter W. G., Hunter J. S.: Statistics for Experimenters – An Introduction to Design, Data Analysis and Model Building. Wiley, New York 1978.
2. Ryan T. P.: Modern Regression Methods. Wiley, New York 1997.

Subject Title: Raw Materials in Chemical Industry

Semester: 5th

Weekly Load and Assessment: 2/1/0 c,Ex

Credit: 4

Language: English

Course provider: Department of Organic Technology

Annotation:

1. Object information's content, relationship between chemical production, power and environment
2. Raw materials for electrolytic production of NaOH, chlorine and its compounds
3. Nitrogen, ammonia, nitric acid
4. Phosphorus and sulfur containing raw materials, manufacture of fertilizers
5. Raw material for glass manufacture, recovery and treatment
6. Inorganic binders: raw materials and basic products
7. Ceramic and refractory materials
8. Crude oil: occurrence, recovery, composition, primary and secondary processing
9. Ethylene production by steam cracking, raw material base for petrochemistry
10. Materials for polymers production
11. Natural gas, production of hydrogen, syngases and carbon oxides
12. Coal: present and future utilization in power and chemical industries
13. Renewable carbonaceous sources, power utilization of biomass
14. Control test

Subject Title: Catalysis

Semester: 5th

Weekly Load and Assessment: 2/1/0 c,Ex

Credit: 4

Language: English

Course provider: Department of Organic Technology

Annotation:

1. Principle of accelerating and directing chemical reactions
2. Heterogeneous, homogeneous and enzyme catalysis
3. Structure and properties of catalytic complexes
4. Thermodynamic limits of catalysis
5. Kinetics of catalyzed reactions
6. Transport phenomena in solid catalysts
7. Texture of solid catalysts
8. Testing of catalytic activity
9. Characterization of catalysts I (methods: AES, EMPA, ESCA)
10. Characterization of catalysts II (methods:DR-FTIR, LBA, ISS,LEED, SIMS)
11. Characterization of catalysts III (methods: SAXS, SEM, XDA, EXAFS)
12. Manufacture, deactivation and regeneration of catalysts
13. Examples of catalytic applications in various industrie
14. Environmental catalysis

Subject Title: Materials Corrosion

Semester: 5th

Weekly Load and Assessment: 2/1/0 c, Ex

Credit: 4

Language: English

Course provider: Department of Metals and Corrosion Engineering

Annotation:

15. Thermodynamics and kinetics of metallic corrosion.
16. Environmental and metallurgical factors in metallic corrosion.
17. Corrosion types and their mechanismus.
18. Metallic corrosion in different environments.
19. Corrosion protection of metals by alloy and coating selection.
20. Electrochemical protection, environment modification, design.
21. Corrosion literature, testing and monitoring.
22. Plastics, terms definition, thermal resistance.
23. Weathering, photochemical processes, plastics stabilization.
24. Chemical resistance of plastics, environmental aspects.
25. Dissolution of inorganic nonmetallic substances in liquids.
26. Silicate glasses corrosion in aqueous solutions.
27. Protective enamel coatings on metals.
28. Corrosion of ceramics and concrete.

Subject Title: Chemical Engineering II

Semester: 5th

Weekly Load and Assessment: 2/3 /0 c, Ex

Credits: 6

Language: English

Course provider: Department of Chemical Engineering

Annotation:

1. Fluid mechanics, equation of continuity, equations of motion, fluid flow in pipes.
2. Flow out of reservoirs – containers, hazards and safety. Centrifuges and cyclones.
3. Flow through beds of solids, pressure drop. Multi-phase flow.
4. Hydromechanical separations of dispersion systems. Kinetics of filtration. Settling.
5. Dispersion systems. Fluidization: quantitative description of fluidized bed. Bubble columns.
6. Dimensional analysis, dimensionless groups, correlations. Principles of modelling. Analogy.
7. Radiation heat transfer. Heat exchange in flowing fluids; cooling, heating and sterilization.
8. Convective and diffusive mass transfer. Mass exchange at interfaces.
9. Mass transfer: concepts of equilibrium-stage and diffusional processes.
10. Continuous rectification of binary and multi-component mixtures.
11. Membrane processes: gas permeation, reverse osmosis, pervaporation, ultrafiltration.
12. Continuous stirred tank reactor, cascades. Tubular reactor. Heterogeneous reactors. Reactors with nonideal flow.
13. Bioreactors, microorganism cultivation, growth and production. Fermentors, enzyme reactors.
14. Adsorption and chromatography. Crystallization from solutions. Crystallizers.

Subject Title: Analytical Chemistry II

Semester: 5th

Weekly Load and Assessment: 2/1/0 c, Ex

Credit: 4

Language: English

Course provider: Department of Department of Analytical Chemistry

Annotation:

1. Analytical chemistry in applications (requirements, techniques, examples)
2. Security
3. Criminalistics
4. Cultural heritage
5. Materials
6. Microcosmos
7. Foods
8. Processes
9. Sensors
10. Sport and household
11. Structure
12. Cosmos
13. Health
14. Environment

Subject Title: Physical Chemistry: Laboratory II

Semester: 5th

Weekly Load and Assessment: 0/0/3 c

Credit: 2

Language: English

Course provider: Department of Physical Chemistry

Annotation:

7. Calorimetry II - enthalpy of combustion
8. Kinetics of second-order reaction
9. Measurement of cell electromotive force - determination of activity coefficients
10. Partial molar volumes in binary system
11. Two-components phase equilibrium - vapour-liquid equilibrium
12. Activation energy of first- and second-order reactions

Subject Title: Characterization Methods for Polymeric Materials

Semester: 5th

Weekly Load and Assessment: 2/0/2 Ex

Credit: 4

Language: English

Course provider: Department of Polymers

Annotation:

1. Polymers, classification, processable properties, normalization.
2. Flow properties of polymers, viscosity measurements, flow curves.
3. Absolute methods of polymers viscosity measurement, rotary, capillary etc.
4. Contractual methods of polymers consistency and fluidity measurement.
5. Evaluation of elastomers plasticity, deformation and rotation methods.
6. Vulcanization characteristics of rubber mixtures, devices.
7. Mechanical properties, preparation and conditioning of test pieces.
8. Static short-time tests, tension, pressure, kink, modulus.
9. Creep and relaxation long-time tests.
10. Cyclic and uncyclic (one-going) dynamic tests, loss angle.
11. Damping properties, dynamic fatigue, wear tests.
12. Thermal properties, ageing, corrosion, thermomechanical curves.
13. Thermal analysis of polymers, optical and electrical properties.
14. Spectral methods - UV and IR, their use at polymer analysis.

Subject Title: Safety Legislation in Chemistry

Semester: 5th

Weekly Load and Assessment: 2/0/0 Ex

Credit: 3

Language: English

Course provider: Department of Inorganic Chemistry

Annotation:

1. Act on chemical substances and chemical preparations and on an amendment to certain other acts (356/2003)
2. Source of information to realization act 356/2003 – description single database, indices materials amenable registration
3. Material Safety Data Sheet (MSDS), R,S-phrases, packaging, labelling
4. Decree of the Government No 258/2001 Coll. – List of hazardous chemical substances and chemical preparations
5. Placing of selected hazardous substances and preparations on the market and putting them into circulation
6. General principles of the classification of substances and preparations- conventional calculation methods for evaluating the hazardous properties of preparations based on their physical and chemical features, hazardous to human health and hazardous to the environment.
7. Hazardous reactions of common chemical substances and chemical preparations
8. Hazardous substances, minimum concentrations of hazardous substances to be taken into account for classifications of substances and preparations, concentration limits for changes to the classification of hazardous preparations
9. First aid measures, after inhalation, skin contact, eye contact.....
10. Act on chemical substances and chemical preparations and on an amendment to certain other acts in practice
11. Law on the prevention of major accidents caused by selected chemical substances and chemical preparations in the wording of later regulations
12. Regulation (EC) No 761/2001 allowing voluntary participation by organisations in a Community eco-management and audit scheme
13. Act No 185/2001 on waste and amendment of some other acts
14. Preparations and productions of dangerous chemical substances and chemical preparations (Examples of explosives, oxidizer, highly inflammable, highly toxic etc.)

Subject Title: Technical Mineralogy

Semester: 5th

Weekly Load and Assessment: 2/1/0 c,Ex

Credit: 4

Language: English

Course provider: Department of Glass and Ceramics

Annotation:

1. Introduction, optical properties of crystals
2. Evaluation of optical properties of crystals in polarized light
3. Measurement of refractive index, extinction, interference colors
4. Measurement of high of interference colors, sign of elongation, optical character
5. Anomalous behavior of crystals, special methods of optical microscopy
6. Measurement of dimensions, microphotography, introduction in raw materials
7. Kaolin, clays
8. Flint clays, siliceous raw materials
9. Feldspar
10. Carbonates
11. Microscopy of ceramic
12. Microscopy of glass and defects in glass
13. Microscopy of inorganic binders
14. News in ceramic materials

Subject Title: Physics of Polymers

Semester: 5th

Weekly Load and Assessment: 2/1/0 c, Ex

Credit: 4

Language: English

Course provider: Department of Polymers

Annotation:

1. Molecular structure, conformation, intermolecular forces, morphology of polymers.
2. Molar mass distribution, its effect on polymer properties.
3. Network creation, theory of crosslinking.
4. Glass transition and free volume concept.
5. Thermodynamics and kinetics of crystallization.
6. Theory of rubber elasticity, its applications.
7. Viscoelasticity, models, Boltzmann superposition principle.
8. Transitions and polymer structure. time-temperature superposition.
9. Polymer melt flow properties - effects of shear rate, molar mass, temperature.
10. Mechanical properties. Introduction to fracture mechanics.
11. Miscibility and solubility of polymers. Swelling equilibrium. Phase separation.
12. Effects of anisotropy (orientation) on polymer properties. Polymer composites.
13. Electrical conductivity. Dielectric properties.
14. Diffusion of gases in polymer membranes. Heat capacity.

Subject Title: Fundamentals of Glass and Ceramic Technologies

Semester: 5th

Weekly Load and Assessment: 2/1/0 c,Ex

Credit: 4

Language: English

Course provider: Department of Glass and Ceramics

Annotation:

1. Inorganic nonmetallic materials – basic types and their characteristics
2. Basic substances and systems, vitreous and crystalline state
3. Fundamentals of the inorganic glass technology – raw materials, melting, forming, annealing
4. Basic types of inorganic glasses and their properties
5. Glass-ceramics, principles of production, types and properties
6. Structure, phase composition and properties of ceramic materials
7. Fundamentals of the ceramics technology
8. Basic types of ceramic materials and their properties
9. Ceramics based on oxides, carbides and nitrides, engineering ceramics
10. Inorganic non-metallic surface layers
11. Inorganic non-metallic biomaterials
12. Refractory materials – types and properties
13. Fundamentals of the inorganic binding materials technology, mechanism of setting and hardening
14. Basic types of inorganic binding materials and their properties

Subject Title: Properties and Testing of Metals

Semester: 5th

Weekly Load and Assessment: 2/1/0 c, Ex

Credit: 4

Language: English

Course provider: Department of Metals and Corrosion Engineering

Annotation:

1. Study of metal and alloy structure. Metallography.
2. Optical and electron microscopy.
3. Elastic and plastic properties of metals.
4. Lattice defects – their influence on mechanical properties.
5. Strengthening of metals.
6. Tensile, bend, shear and torsion tests.
7. Hardness tests.
8. Critical states of material. Fracture mechanism, tough and brittle fracture.
9. Fracture toughness and toughness test.
10. Fatigue of materials.
11. High temperature mechanical properties of metals. Creep.
12. Non-destructive testing of materials.
13. Methods of study of phase transformations in metals.
14. Testing of casting properties of metals.

Subject Title: Introduction to Electronics

Semester: 5th

Weekly Load and Assessment: 2/0/0 Ex

Credit: 3

Language: English

Course provider: Department of Solid State Engineering

Annotation:

1. Basic concepts and quantities of electronics.
2. Simple semiconductor devices.
3. Basic properties of transistors.
4. Principle of electronics network searching.
5. Harmonic signal networks.
6. RC and RLC passive circuits.
7. Simple amplifier circuit.
8. Non-linear networks, signal distortion, harmonic analysis.
9. Principle of feedback, application, control circuit.
10. Operation amplifier, application.
11. Bases of digital technique.
12. Simple logic networks, memories.
13. Transmission of signals.
14. Data processing.

Literature

Foit J.: Electronics, CTU Prague, 1999.

Balabanian N.: Electric circuits. McGraw-Hill, 1994.

Subject Title: Analytical Chemistry: Laboratory II

Semester: 6th

Weekly Load and Assessment: 0/0/4 c

Credit: 3

Language: English

Course provider: Department of Analytical Chemistry

Annotation:

1. Atomic absorption spectrometry
2. Gas chromatography
3. NMR spectrometry
4. Fluorimetry
5. Flow injection analysis
6. Near infrared spectrometry

Subject Title: Fine Chemicals

Semester: 6th

Weekly Load and Assessment: 2/1/0 c,Ex

Credit: 4

Language: English

Course provider: Department of Organic Technology

Annotation:

1. General chemical and physical properties of inorganic pigments
2. Color properties, color measurement
3. Behavior of pigments in binders
4. White pigments
5. Titanium dioxide
6. Colored pigments
7. Magnetic, anticorrosive, luster and transparent pigments
8. Organic dyes and pigments
9. Surface- active agents
10. Ionic and nonionic surfactants
11. Biologically active compounds
12. Pesticides
13. Flavours and fragrances
14. Polymer aditives

Subject Title: Chemical and Physical Principles of Buildings Sanitation

Semester: 6th

Weekly Load and Assessment: 2/0/0 Ex

Credit: 3

Language: English

Course provider: Department of Chemical Technology of Monument Conservation

Annotation:

1. Clay materials and their properties, adobe.
2. Brick and roof tiles and their properties
3. Lime and its properties
4. Plaster and its properties
5. Cement and its properties
6. Mortars and their composition, structure and properties
7. Coat and their composition, structure and properties
8. Special coat, principles and properties
9. Surface finishing of fasade, materials and their properties
10. Lime paint, cement paint, silicate paint etc.
11. Fasade cleaning
12. Mechanism of ageing and corrosion of building materials
13. Possibilities of consolidation and conservation of damaged building materials
14. Methodical approach to reconstruction and conservation of historic buildings

Literatura

1. Torraca G.: Poróse Baustoffe , ICCROM 1986,
2. Weber H. a spol.: Fassadenschutz und Bausanierung, Expert Verlag, SRN 1994
3. Ashurst, J., Ashurst, N.: Practical Building Conservation - Heritage Technical Handbook - Mortars, Plasters and Renders, Alderhot, Gower Technical Press, 1988
4. Ashurst, J., Dinus, F.G.: Conservation of Building and Decorative Stone - volume 1 and 2, Butterworth – Heinemann, 1990
5. Coburn, A., Dudley, E., Spence, R.: Gypsum plaster - Its manufacture and use, Intermediate Technology Publications, London 1989

Subject Title: Metallurgy

Semester: 6th

Weekly Load and Assessment: 2/0/0 Ex

Credit: 3

Language: English

Course provider: Department of Metals and Corrosion Engineering

Annotation:

1. Dressing of primary raw materials (physical and physical-chemical processes)
2. Roasting (sulphating, oxidizing, chloridising,), thermal decomposition
3. Reduction metallic oxides and halides
4. Reduction smelting, function and properties of slags
5. Production of pig iron
6. Steelmaking, steel refining
7. Production of lead and zinc by the roast-reductive process
8. Matte (concentrating) smelting, production of copper and nickel
9. Fused salt electrolysis, production of aluminium and magnesium
10. Pyrometallurgical refining processes, production of pure metals
11. Principles of hydrometallurgical production of metals
12. Leach liquors refining, isolation of metals from solutions, electrochemical refining
13. Hydrometallurgical production of zinc
14. New processes of metal production, utilization of metallurgical processes to improve the environment

Subject Title: Automatic Control in Glass and Ceramics Industry

Semester: 6th

Weekly Load and Assessment: 2/1/0 c,Ex

Credit: 4

Language: English

Course provider: Department of Glass and Ceramics

Annotation:

1. Principles of system analysis
2. System problems and applications in technological processes (TP)
3. System analysis of ceramics manufacture
4. Automatic control systems of technological processes (ACSTP)
5. Control technique of TP
6. Exercise of computer technology and human operator in control of TP
7. Function of ACSTP
8. Control computers (hardware and software)
9. Batch plant control
10. Control of glass and ceramics furnaces
11. Control of forming processes
12. Control of annealing lehrs
13. Control of decorating machines
14. Control of inspection operations

Subject Title: Materials for Electronics

Semester: 6th

Weekly Load and Assessment: 2/1/0 c,Ex

Credit: 4

Language: English

Course provider: Department of Solid State Engineering

Annotation:

1. Materials yesterday, today and tomorrow – primary terms and problems
2. Methods of material characterization, results processing, norms
3. Correlation of the material microstructure and physico-chemical properties of materials
4. Structure defects, effect on material properties, stability, corrosion
5. Transport – electrical, magnetical and thermal properties, losses
6. Materials for isolators in electro-applications, strenght, losses
7. Dielectrics – optical materials and liquid crystals
8. Ferroelectrics, piezoelectrics, pyroelectrics
9. Semiconductor materials, non-typical applications
10. Conductors and materials on the basis of carbon
11. Superconductors and their applications
12. Primary parameters of the magnetic materials
13. Magnetic recording, classical, perpendicular, magneto-optical
14. Advanced materials, present methods of the material research

Subject Title: Technology of Polymer Materials Processing

Semester: 6th

Weekly Load and Assessment: 2/0/0 Ex

Credit: 3

Language: English

Course provider: Department of Polymers

Annotation:

1. Preliminary processing of polymers and additives.
2. Compression and transfer moulding, moulds design.
3. Calendering of plastics and elastomers, calendering lines.
4. Extrusion, operation principle of single and twin screw extruders.
5. Design of extrusion dies, extrusion lines.
6. Injection moulding, effect of process parameters on product quality.
7. Bottles and hollow parts production.
8. Thermoforming, cold forming.
9. RIM, plastic and rubber foam production.
10. Fibre spinning, laminates production.
11. Dipping, casting, coating, adhesive bonding, painting.
12. Welding, stamping, printing, surface treatment.
13. Rules of plastics part design.
14. Polymer waste reprocessing.

Faculty of Chemical Technology

STUDY PROGRAMME: Applied Chemistry and Materials

Field of Study: Informatics and Chemistry

Characteristics:

The study provides practical knowledge of the essentials of advanced electronic processing and publication of information. Students get acquainted with procedures applied in library science and publishing, and they learn to apply the acquired knowledge in projects relating to chemistry and environmental protection. They also gain practical skills in working with state-of-the-art technologies used in electronic publishing (e-publishing).

Graduate profile:

Given the balanced combination of IT, chemical and general subjects, graduates may pursue careers in fields such as intellectual property management, technical information service in an editorial office or library, technological support in distance education centres, media relations management or state administration, i.e. in professions focused on information processing and publishing and requiring an all-round approach and universal technical education. Graduates may find jobs as widely sought-for information specialists. In addition, they are equipped with a good knowledge of applied natural sciences and technical fields and may thus work in both traditional and modern fields of chemistry, chemical technology and engineering.

Study Year: 1

Winter Semester

<i>Code</i>	<i>Required Subjects</i>	<i>Dep.</i>	<i>L</i>	<i>S</i>	<i>Lab</i>	<i>Assessment</i>	<i>Credits</i>
Required Subjects							
N101005	General and Inorganic Chemistry I	101	3	2	0	c,Ex	8
N413002	Mathematics I	413	3	3	0	c,Ex	9
N409046	Operating Systems and Networks	409	2	2	0	c,Ex	5
N112021	Internet Publishing	111	2	2	0	c,Ex	5
N101002	Chemical Calculations	101	0	2	0	c	2
N963006	Introduction to Studies	963	1	0	0	c	1
N827001	Physical Education	827	0	2	0	c	0

Summer Semester

<i>Code</i>	<i>Required Subjects</i>	<i>Dep.</i>	<i>L</i>	<i>S</i>	<i>Lab</i>	<i>Assessment</i>	<i>Credits</i>
Required Subjects							
N110004	Organic Chemistry I	110	3	2	0	c,Ex	7
N112022	Fundamentals of Ecology	112	3	0	0	Ex	4
N111503	Chemical Informatics	111	0	2	0	c	2
N112024	XML Technologies	112	2	2	0	c,Ex	5
N112025	Term project I – personal web presentation	111	0	6	0	c	6
N834001	Language I	834	0	2	0	c	0
N827002	Physical Education	827	0	2	0	c	0
Semi-elective Subjects 1 a 2							
N413003	Mathematics II	413	3	3	0	c,Ex	8
N444001	Physics I	444	3	2	0	c,Ex	7
N101006	General and Inorganic Chemistry II	101	2	2	0	c,Ex	5
N832013	Law Basics	832	2	0	0	Ex	3
N832011	Human Resources Management	832	2	1	0	c,Ex	4
Recommend Subject							
N444002	Fundamentals of Physics: Repetition	444	0	2	0		0
Elective Subjects							
	Elective Subjects for the 2nd Semester						

Study Year: 2

Winter Semester

<i>Code</i>	<i>Required Subjects</i>	<i>Dep.</i>	<i>L</i>	<i>S</i>	<i>Lab</i>	<i>Assessment</i>	<i>Credits</i>
Required Subjects							
N112031	Library Science	112	2	0	0	c	2
N403011	Physical Chemistry I	403	3	2	0	c,Ex	7
N320001	Biochemistry I	320	3	0	0	Ex	5
N112026	Transformation and Processing of XML Documents	112	2	2	0	c	5
N112027	Informatics and Chemistry: Semestral Project II	112	0	6	0	c	6
N834002	Language II	834	0	2	0	c,Ex	0
N827003	Physical Education	827	0	2	0	c	0
Semi-elective Subject 3							
N110005	Organic Chemistry II	110	2	1	0	c,Ex	4
N444006	Physics II	444	2	2	0	c,Ex	5
N437022	Fundamentals of Marketing Chemical Products	437	2	0	0	Ex	3
Elective Subjects							
Elective Subjects for the 3rd Semester							

Summer Semester

<i>Code</i>	<i>Required Subjects</i>	<i>Dep.</i>	<i>L</i>	<i>S</i>	<i>Lab</i>	<i>Assessment</i>	<i>Credits</i>
Required Subjects							
N112032	Fundamentals of Editorial Work	112	2	0	0	Ex	3
N409002	Chemical Engineering I	409	2	3	0	c,Ex	6
N110020	Toxicology	110	2	0	0	Ex	3
N402002	Analytical Chemistry I	402	2	1	0	c,Ex	4
N413004	Applied Statistics	413	1	2	0	c,Ex	4
N112028	Informatics and Chemistry: Semestral Project III	112	0	6	0	c	6
N827004	Physical Education	827	0	2	0	c	0
Semi-elective Subject 4							
N111006	Environmental Protection Processes	111	2	1	0	c,Ex	4
N403014	Physical Chemistry II	403	3	2	0	c,Ex	7
N437006	Accounting	437	2	2	0	c,Ex	5
Elective Subjects							
Elective Subjects for the 4th Semester							

Study Year: 3

Winter Semester

<i>Code</i>	<i>Required Subjects</i>	<i>Dep.</i>	<i>L</i>	<i>S</i>	<i>Lab</i>	<i>Assessment</i>	<i>Credits</i>
Required Subjects							
N409047	Informatics and Chemistry: Semestral Project IV	409	0	6	0	c	6
N101013	Chemistry and Data Processing: Laboratory	101	0	0	4	c	3
Semi-elective Subjects 5 and 6							
N409003	Chemical Engineering II	409	2	3	0	c,Ex	6
N402004	Analytical Chemistry II	402	2	1	0	c,Ex	4
N101001	Safety and Legislation in Chemistry	101	2	0	0	Ex	3
N112030	Ecological Informatics	112	2	0	0	c	2
N112029	Scripting Languages	112	2	2	0	c,Ex	5
N409049	Databases	409	2	2	0	c,Ex	5
Elective Subjects							
	Elective Subjects for the 5th Semester						

Summer Semester

<i>Code</i>	<i>Required Subjects</i>	<i>Dep.</i>	<i>L</i>	<i>S</i>	<i>Lab</i>	<i>Assessment</i>	<i>Credits</i>
Required Subjects							
N963007	Bachelor work	963	0	0	8	SFE	10
Semi-elective Subjects 7 and 8							
N445006	Computer Graphics	445	1	3	0	c,Ex	5
N108014	Computer Graphics for Visualising the Structure of Molecules	108	2	0	0	Ex	3
N112013	Advanced Chemical Informatics	112	0	3	0	c	3
N409048	Fundamentals of Programming in C	409	2	2	0	c,Ex	5
N126021	Transmission and Processing of Information	126	2	0	0	Ex	3
N108013	Chemistry of the Environment	108	3	0	0	Ex	4
Elective Subjects							
	Elective Subjects for the 6th Semester						

Subject Title: General and Inorganic Chemistry I

Semester: 1st

Weekly Load and Assessment: 3/2/0 c, Ex

Credit: 8

Language: English

Course provider: Department of Inorganic Chemistry

Annotation:

1. Structure of atom, atomic orbitals and their occupation. Configuration of valence sphere.
2. Periodic law. Classification of elements. Vertical and horizontal similarities.
3. Chemical bond. Covalent and ionic bond, electronegativity, polarization force.
4. Stoichiometry of compounds of nontransition elements. Structural formulas and their utilization.
5. Hybridization of AO. Structure and properties of molecules nontransition elements.
6. Hydrogen, oxygen, bonding possibilities. Water, aqueous solutions, acids and bases.
7. Halogens, rare gases, bonding possibilities. Compounds of halogens, redox reactions.
8. Sulfur, bonding possibilities, important compounds. Factors influencing reaction path.
9. Nitrogen, bonding possibilities. Chemical equilibrium and kinetics. Compounds of nitrogen.
10. Phosphor. Compounds of phosphor, polyanions. The most important inorganic compounds.
11. Carbon, silicon and their compounds, bonding possibilities of elements of the 2-nd and higher periods.
12. Production of important metals, metal bond and properties of metals, metal corrosion.
13. Nontransition metals, bonding possibilities, group trends, diagonal relationship.
14. Transition metals, bonding possibilities, trends in groups and periods.

Subject Title: Mathematics I

Semester: 1st

Weekly Load and Assessment: 3/3/0 c, Ex

Credit: 9

Language: English

Course provider: Department of Mathematics

Annotation:

29. Elements of Mathematical Logic. Introduction to calculus.
30. Continuity and limits of the functions of one and two variables.
31. Derivatives, Mean value theorem, L' Hospital's rule. Partial derivatives.
32. Monotone functions, extreme values of a function, asymptotes of the graph.
33. Newton's methods. Taylor's formula with remainder. Differential.
34. Curves in plane, tangent vector. Polar coordinates.
35. Indefinite integral. Definite integral. Applications in Geometry and Physics.
36. Techniques of integration.
37. Improper integrals. Numerical integration. The mean value theorem for integrals.
38. Ordinary differential equations of the first order. Separable equations.
39. Linear differential equations of the first order and their applications. Euler's method.
40. The space \mathbb{R}^n , geometry in \mathbb{R}^3 , vectors, dot and cross products.
41. Matrices and Determinants. Inverse matrix.
42. The systems of linear algebraic equations. Gauss-Jordan method. Cramer's rule.

Subject Title: Operating Systems and Networks

Semester: 1st

Weekly Load and Assessment: 2/2/0, c, Ex

Credit: 5

Language: English

Course provider: Department of Chemical Engineering

Annotation:

15. Introduction. History.
16. Principles and overview of computer hardware. Relation between hardware and software. Program, process, thread.
17. Principles of computer networks. Network components. Types of networks. Network architectures. OSI model.
18. Operating system principles. Types of operating systems.
19. Operating systems of the Windows type.
20. Networks and operating systems of the Windows type.
21. UNIX operating systems.
22. Networks and UNIX.
23. Network operating systems. Novell Netware.
24. Networks in heterogeneous environment. Cooperation of computers with different operating systems. NFS systems.
25. Remote access to other computers. FTP and Telnet.
26. Principles of network administration. The role of the network administrator.
27. Problems of security in computer networks. Security gaps in Windows operating systems and their removal.
28. Organization of a computer network within a company or institution.

References

1. Silberschätz, Galvin, Gagne: *Operating System Concepts*, 6th edition (Windows XP update), Wiley, 2003
2. Vaněk T.: *Electronic version of lecture notes*.
3. Other sources according to the actual offer of monographs and other titles on the market.

Subject Title: Internet Publishing

Semester: 1st

Weekly Load and Assessment: 2/2/0 c, Ex

Credit: 5

Language: English

Course provider: Department of organic technology

Annotation:

1. Introduction – web servers and web browsers
2. HTML – basic page structure
3. HTML – basic constructions, data transfers via FTP
4. HTML - forms
5. CSS
6. CSS vs. HTML comparison
7. JavaScript - basics
8. Graphical data and multimedia - formats (GIF, PNG, JPEG), usage
9. Usability - homepage
10. Usability - navigation, search, JavaScript
11. Usability – web design for handicapped users (lowered sight or movement capabilities, older persons, etc.)
12. Anonymity of internet users, personal data protection, spam
13. Legal and moral aspects - quotation, referring, responsibility for published content
14. Presentation of created projects

Literatura

Subject Title: Chemical Calculations

Semester: 1st

Weekly Load and Assessment: 0/2/0 c

Credit: 2

Language: English

Course provider: Department of Inorganic Chemistry

Annotation:

1. Basic physical properties and units. Composition of mixtures and compounds.
2. Preparation of solutions of pure and/or impure substances.
3. Preparation of solutions by dilution or by mixing of different solutions.
4. Stoichiometry calculations (including reactions of the ideal gas).
5. Stoichiometry calculations, reactions with an excess of reactants.
6. Preparation of solutions and stoichiometry calculations.
7. Saturated solutions, solution preparation by dissolving or concentrating.
8. Saturated solutions, disturbed crystallisation.
9. Recapitulation.
10. Test.
11. Recapitulation.
12. 1. Test reparation.
13. Recapitulation.
14. 2. Test reparation.

Subject Title: Organic Chemistry I

Semester: 2nd

Weekly Load and Assessment: 3/2/0 c, Ex

Credit: 7

Language: English

Course provider: Department of Organic Chemistry

Annotation:

1. Introduction, main groups of organic compounds. Oxidation state.
2. Nomenclature of organic compounds – functional groups.
3. Shape of organic compounds – introduction to stereochemistry.
4. Alkanes, radical substitution, structure of free radicals.
5. Alkenes, addition reactions, structure and stability of carbocations.
6. Dienes, pericyclic reactions, alkynes.
7. Arenes, regioselectivity of electrophilic substitution, oxidation and reduction.
8. Haloderivatives, organometallic compounds, S_N .
9. Hydroxyderivatives, eliminations and rearrangements.
10. Organic derivatives with S, N, P functional groups.
11. Aldehydes and ketones. A_N .
12. Aldehydes and ketones – enolates and their reactions.
13. Carboxylic acids – mechanism esterification.
14. Derivatives of carboxylic acids.

Subject Title: Fundamentals of Ecology

Semester: 2nd

Weekly Load and Assessment: 3/0/0 c, Ex

Credit: 5

Language: English

Course provider: Department of Polymers

Annotation:

1. Basic ecological and biological terminology
2. Evolution
3. Ethology
4. Abiotic factors
5. Inter-species interactions
6. Population dynamics
7. Ecological relations in time and space
8. Biodiversity
9. Invasive organisms
10. Economy and ecology
11. Sociology and ecology
12. Natural ecosystems
13. Artificial ecosystems
14. Sustainable development

Subject Title: Chemical Informatics

Semester: 2nd

Weekly Load and Assessment: 0/2/0 c

Credit: 2

Language: English

Name of lecturer: Ing. Jaroslav Šilhánek, CSc
Ing. Petr Kačer, PhD

Course provider: Department of Physics and Measurements

Objective of the course (expected learning outcomes and competences to be acquired)

Students will get overall understanding of basic principles of communication of scientific knowledge, their distribution, archiving and searching. The aim of the course is to provide students with practical skill in working with information based on standard principles and structures with modern information technologies

Prerequisites

Basic skill in using computers and network communication is expected

Course contents

29. Information as physical and social concept and its specific meaning in science.
30. Mechanism of distribution, storage, and searching of scientific information
31. Analysis, classification and indexing of scientific publications
32. Modern information technologies and their impact on work-up of scientific publication.
33. Concept of scientific databases, different types, structures and usage.
34. General strategy of databases usage, technical and economic aspects.
35. Specific situation in chemistry and some other branches of natural science.
36. Libraries, their organization and usage in past and in present times.
37. Chemical Abstracts as fundamental and indispensable information source for all chemistry disciplines.
38. Chemical compound and its structure as key element of chemical information.
39. Representation of chemical structures in digital form, structure and reaction databases.
40. Patent as specific form of technical and scientific information, patent databases and other aspects of patent information.
41. Toxicological, environmental, biotechnological and other kind of information related to chemistry.
42. Assessment of present situation in chemical information and its perspectives Language of instruction Czech/English

Recommended reading

- Jaroslav Šilhánek: Chemická informatika, Praha 2002.
Jaroslav Šilhánek: Science Citation Index - Web of Science, Praha 2000.
Jaroslav Šilhánek, Ludmila Zetková: Chemical Abstracts on CD-ROM. Praha 1997.
Robert E. Maizell: How to find Chemical Information, J.Wiley 1998.
Damon Ridley: Information Retrieval. SciFinder® and SciFinder® Scholar, J.Wiley 2002.

Johann Gasteiger, Thomas Engel: Chemoinformatics, A Textbook,
J.Wiley-VCH 2003.

Teaching methods

Seminars

Assessment methods

Oral/written examination/practical work

Language of instruction

Czech/English

Subject Title: XML Technologies

Semester: 2nd

Weekly Load and Assessment: 2/2/0 c, Ex

Credit: 5

Language: English

Course provider: Department of Polymers

Annotation:

15. Document publishing and storage: history and present
16. XML: advantages, current and future use, syntax, tools
17. XHTML: web document structure, basic XHTML elements and attributes
18. Displaying XML documents using CSS technology
19. SVG: vector graphics in XML
20. MathML: mathematics in XML
21. CML – chemistry in XML
22. Introduction to XSLT
23. XSL FO – formatting XML documents for print
24. Formal structure of documents and their validation I - DTD
25. Formal structure of documents and their validation I – XML Schema, Relax NG
26. Namespaces
27. Combining XML formats
28. Web services

Subject Title: Term project I – personal web presentation

Semester: 2nd

Weekly Load and Assessment: 0/6/0 c

Credit: 6

Language: English

Course provider: Department of organic technology

Annotation:

1. Students will create their website on the start of the project, containing the report of the progress of their studies. The report will have to be kept up to date with their latest achievements in their studies, projects, exams, etc. Therefore, students will have opportunity to familiarize with the basics of website administration needed for higher level term projects.
2. The second part of the project consists in creating a web presentation of selected topics of "Basic ecology" and "Basic chemical informatics" subjects.

[Literatura](#)

Subject Title: Mathematics II

Semester: 2nd

Weekly Load and Assessment: 3/3/0 c, Ex

Credit: 8

Language: Czech, English

Prerequisites: Mathematics I

Course provider: Department of Mathematics

Annotation:

1. Linear space, base, dimension. The space $C(I)$. Linear mapping.
2. Linear differential equations of n-th order.
3. The system two linear and nonlinear differential equations of the first order.
4. Predator-Prey models: Lotka-Wolterra System.
5. Geometry in \mathbb{R}^3 (\mathbb{R}^n). Metrics in \mathbb{R}^n .
6. Differential calculus in \mathbb{R}^n . The functions of two and more variables.
7. Directional and partial derivatives. Tangent plane. Gradient. Newton's method.
8. Taylor's formula. The Hessian and extreme values. Method of least squares.
9. Implicit function theory.
10. Line integral of scalar and vector field.
11. Differential form, exact differential form, Potential vector field.
12. Line integrals independent of the path.
13. Double integrals. Fubini theorem, Substitution in double integral. Improper integrals.
14. Triple integrals. Applications. Cylindrical and spherical coordinates.

Subject Title: Physics I

Semester: 2nd

Weekly Load and Assessment: 3/2/0 c, Ex

Credit: 7

Language: English

Course provider: Department of Physics and Measurements

Annotation:

1. Basic concepts of mechanics I: Force, the Newton's laws, work, power, kinetic and potential energy. Conservation of mechanical energy and linear momentum, elastic and inelastic collisions.
2. Basic concepts of mechanics II: Moment of inertia, torque, angular momentum. Work, power and energy in rotational motion. Rolling motion of rigid bodies. Static equilibrium conditions, center of gravity.
3. Introduction to the kinetic theory of gases: Kinetic interpretation of pressure and temperature. Average kinetic energy of molecules. Velocity distribution of molecules. Mean free path of a molecule.
4. Continuum and fluid mechanics: Forces in continuum, deformation, Hooke's law. Hydrostatic pressure, Archimedes' law. Bernoulli's equation, real liquid flow.
5. Oscillations: undamped, damped and forced harmonic oscillations. Composed oscillations.
6. Waves: description, propagation velocity, intensity. Huygens principle, refraction and reflection, Snell law. Interference, standing waves.
7. Electrostatic field: Coulomb's law. Electric dipole. Potential, voltage, work. Capacitor, dielectric polarization. Charge motion in an electric field.
8. Direct current circuits: Ohm's law, Joule law. Kirchhoff's rules. Current, voltage and resistance measurements.
9. Magnetic field: Magnetic force. Mass spectrograph, electric measurement instruments, cyclotron, the Hall effect. Biot-Savart law, Ampere's law. Magnetic fields in matter.
10. Electromagnetic field: electromagnetic induction, proper and mutual inductance. Electromagnetic waves, energy of electromagnetic field.
11. Alternating current circuits: Generator. Power. Impedance, phase shift, serial resonance circuit.
12. Wave optics: concept of light, interference, thin film, single-slit diffraction, diffraction grating, polarization, optical activity.
13. Geometric optics: Basic concepts, reflection and refraction, optical instruments: magnifying glass, microscope, telescope.
14. Basic concepts of modern physics: The photoelectric effect, X-rays, the particle-wave duality, absorption, emission, laser.

Subject Title: General and Inorganic Chemistry II

Semester: 2nd

Weekly Load and Assessment: 2/2/0 c,Ex

Credit: 5

Language: English

Course provider: Department of Inorganic Chemistry

Annotation:

1. Atomic orbitals. 3d/4s problem. Molecular orbitals.
2. Periodic law. Vertical and horizontal similarities. p-,d-, a f- contraction.
3. Symmetry of molecules. Hybridization for lowered symmetry cases.
4. Hydrogen, hydrogen bonding, hydrides. Van der Waals interactions and noble gases.
5. Oxygen. Lewis theory of acids and bases. Oxide acidity. Ozone. Peroxides.
6. Halides. Stability of oxidation states. Redox potentials.
7. 16th group – from nonmetals to metals. Homo- and heterocatenating.
8. Nitrogen and phosphorus. Bonding characteristics of the 2nd and lower period elements.
9. Carbon, silicon, boron. Single, multiple and multicentered bonds.
10. Chemical bonding in solids and their properties. Metals, semiconductors, insulators.
11. Principles of crystal chemistry. Structure types.
12. Coordination compounds. Geometrical and optical isomerism. Symmetry.
13. Bonding and properties of coordination compounds. Organometallic compounds.
14. Influence of inert pair and lanthanide contraction on the chemical properties of metals.

Literature: G. E. Rogers, Descriptive Inorganic, Coordination, and Solid State Chemistry, 2nd Ed., Thomson Learning, 2002.

Subject Title: Law Basics

Semester: 2nd

Weekly Load and Assessment: 2/0/0 Ex

Credit: 3

Language: English

Course provider: Department of Social Sciences

Annotation:

27. Private law relations
28. Real rights
29. Law of obligations
30. Civil relations/ Civil law relations
31. Contracts according to Civil Code
32. Entities of business activity
33. Commercial obligations
34. Contracts according to Business Code
35. Housing law
36. Family law
37. Law of succession
38. Judicial proceedings
39. Labor law

Literature:

Civil Substantive Law, vol. I and II, 2nd edit. Codex, Praha 1997,
2nd edit. Codex Bohemie, Praha 1997

Subject Title: Human Resources Management

Semester: 2nd

Weekly Load and Assessment: 2/1/0 c, Ex

Credit: 4

Language: English

Course provider: Department of

Annotation:

29. Fundamental Concepts of Human Ressource Management
30. Human Ressource Planning
31. Job Analysis and Job Design
32. Recruitment, Selection Process
33. Performance Appraisal and Feedback
34. Reward Systems
35. Work Motivation
36. Career Planning and Development
37. Organizational Culture
38. Internal and External Communication Process
39. Work Team
40. Work Stress
41. Approaches to Organization Change
42. Stimulating Organizational Creativity and Cooperative Behavior

Subject Title: Fundamentals of Physics: Repetition

Semester: 2nd

Weekly Load and Assessment: 0/2/0

Credit: 0

Language: English

Course provider: Department of Physics and Measurements

Annotation:

1. Physical quantities, units, changing units
2. Vector calculus
3. Kinematics of motion along a straight line or a curve
4. Dynamics of motion along a straight line
5. Dynamics of motion along a curve
6. Work, power, efficiency, mechanical energy
7. Motion in a gravitational field
8. Rigid body statics
9. Rigid body motion
10. Archimedes' law, hydrostatic pressure
11. Ideal liquid flow
12. Basic problems of geometric optics
13. Basic problems of direct current circuits
14. Basic problems of alternating current circuits

Subject Title: Library Science

Semester: 3rd

Weekly Load and Assessment: 2/0/0

Credit: 2

Language: English

Course provider: Department of Polymers

Annotation:

1. Introduction, basic terminology, library orientation.
2. History of libraries, library system in the Czech Republic, significant world libraries.
3. Information source identification and description.
4. Identification description standards.
5. Identification description of special types of literature.
6. Professional literature citations.
7. Metadata for source description and search.
8. Bibliographic systems and services.
9. Systematic arrangement of information and retrieval languages.
10. Subject arrangement of information and retrieval languages.
11. Documentographic information systems.
12. Library processes.
13. Computerized library systems.
14. Library organization and management.

Subject Title: Physical Chemistry I

Semester: 3rd

Weekly Load and Assessment: 3/2/0 c, Ex

Credit: 7

Language: English

Course provider: Department of Physical Chemistry

Annotation:

15. Basic terminology, thermodynamic system, thermodynamic process, state properties.
16. State behaviour of gases, equation of state of ideal gas. Real gas and its behaviour.
17. 1st law of thermodynamics. Internal energy, heat, work.
18. Enthalpy, heat of reaction, standard enthalpy of formation. Hess and Kirchhoff's laws.
19. 2nd law of thermodynamics, entropy. Entropy changes on selected processes.
20. Helmholtz and Gibbs energy, their significance. 3rd law of thermodynamics.
21. Partial molar quantities, activity, chemical potential, standard states.
22. Material balance of chemical reactions. Equilibrium constant. Equilibria in electrolyte systems.
23. Chemical equilibria of reactions in gaseous phase.
24. Galvanic cells, symbols, usage, Nernst equation.
25. Basic terminology of chemical kinetics, reaction rate, integration of rate equations.
26. Phase equilibria in single-component systems, Clapeyron equation.
27. Gibbs phase law, vapour-liquid equilibrium in ideal systems, phase diagrams.
28. Solubility of gases in liquids, equilibria in condensed systems.

Reading

- Novák J. a kol.: Fyzikální chemie – bakalářský kurz , VŠCHT Praha 2005 (in Czech)
- Novák J. a kol.: Fyzikální chemie II , VŠCHT Praha 2001 (in Czech)
- Atkins P.W.: Physical Chemistry , Oxford University Press 1998 (in English)
- Malijevský a kol.: Physical Chemistry in Brief, VŠCHT Praha 2005, available in English on the Internet (Web pages of the Department of Physical Chemistry)

Subject Title: Biochemistry I

Semester: 3rd

Weekly Load and Assessment: 3/0/0 Ex

Credit: 5

Language: English

Course provider: Department of Biochemistry and Microbiology

Annotation:

1. Living systems, their composition and organisation.
2. Aminoacids (properties, reactions, determination) and peptides.
3. Proteins (relation between structure and function).
4. Enzymes: structure, nomenclature, classification.
5. Reaction kinetics of enzyme reactions, regulation of enzyme actions.
6. Chemistry of nucleotides and nucleic acids, replication.
7. Transcription, translation, posttranslational modifications.
8. Chemistry of lipids. Biomembranes and membrane transport.
9. Principles of metabolism. Bioenergetics.
10. Aerobic and anaerobic respiration, light reactions of photosynthesis.
11. Citric acid cycle and glyoxylate cycle.
12. Chemistry of carbohydrates. Carbohydrate metabolism I.
13. Carbohydrate metabolism II. Lipid metabolism.
14. Metabolism of proteins and nucleic acids.

Subject Title: Transformation and Processing of XML Documents

Semester: 3rd

Weekly Load and Assessment: 2/2/0 c

Credit: 5

Language: English

Course provider: Department of Polymers

Annotation:

1. Basic approaches in transformation of XML documents
2. Query language XPath
3. Functions in XPath
4. Document axes
5. Structure of XSLT stylesheets
6. Modes and named templates
7. Parameters and variables
8. Keys
9. Recursive programming
10. Input and output formats
11. Principles of stylesheet design
12. Chaining and modularization of stylesheets
13. Document object model - DOM
14. Sequential processing of data - SAX

Subject Title: Informatics and Chemistry: Semestral Project II

Semester: 3rd

Weekly Load and Assessment: 0/6/0 c

Credit: 6

Language: English

Course provider: Department of Polymers

Annotation:

1. Projects builds on skills and knowledge achieved in Project I. Each student will focus on specific scientific/technical subject to collect information and to present them in the form of a web portal. The goal of the project is to familiarize students with the use of information technology for complex information collection and interpretation. Emphasis will be on the clarity of the presentation, which will be checked by mutual evaluation by students.

Subject Title: Organic Chemistry II

Semester: 3rd

Weekly Load and Assessment: 2/1/0 c, Ex

Credit: 4

Language: English

Course provider: Department of Organic Chemistry

Annotation:

1. Saccharides – monosaccharides, their structure, stereochemistry, and reactions.
2. Oligo – and polysaccharides.
3. Halogen- , hydroxy- , and unsaturated carboxylic acids.
4. Amino acids, peptides , primary structure.
5. Oxo acids and their synthetic utilisation.
6. Heterocycles.
7. Chemistry of nucleosides, nucleotides and NA.
8. Organic synthesis – methods for alkanes, alkenes, alkynes.
9. Synthetic procedures for monofunctional compounds.
10. Synthesis of aldehydes, ketones and carboxylic acids.
11. Synthesis of functionalized carboxylic acids.
12. Synthesis of heterocycles.
13. Natural products.
14. Methods used for structure determination.

Subject Title: Physics II

Semester: 3rd

Weekly Load and Assessment: 2/2/0 c, Ex

Credit: 5

Language: English

Course provider: Department of Physics and Measurements

Annotation:

1. Electromagnetic field: Maxwell's equations, electromagnetic waves (properties, energy transfer, intensity, polarization).
2. Special relativity: principles, the Lorentz transformation, length contraction, time dilation, velocity transformations. Relativistic dynamic quantities. The mass-energy equivalence.
3. Introduction to quantum physics: Blackbody radiation, the Stefan-Boltzmann law, spectral intensity distributions, the Planck distribution law. Absorption and emission. Laser.
4. Electrons and photons: The photoelectric effect, threshold wavelength and frequency, stopping potential. The Compton effect, X rays, X ray diffraction by a crystal.
5. Wave nature of particles: De Broglie wavelength, electron diffraction by a crystal lattice, electron microscope. The particle-wave duality, the uncertainty principle.
6. Basics of quantum mechanics: wave function and its properties, the probability density. Operators: eigenvalue equations and eigenvalues. The Schroedinger equation.
7. Quantum mechanical solution of simple problems I: Free particle, particle in an infinite square well, energy spectrum, degeneracy.
8. Quantum mechanical solution of simple problems II: Tunnel effect, the harmonic oscillator, energy spectrum of the linear harmonic oscillator. The correspondence principle.
9. The hydrogen atom: particle in a Coulomb potential, energy levels, the atomic spectrum. Quantum numbers of the hydrogen atom, the radial probability density.
10. Quantum mechanical solution of the hydrogen and hydrogen-like atoms: Contour diagrams. The Zeeman effect. Spin of the electron, fine structure of energy levels, spin-orbit interaction.
11. Many-electron atoms: The orbital approximation, effective charge of a nucleus, screening. The building-up principle, the Hund rule, the Pauli exclusion principle.
12. Introduction to solid state physics: Band structure of energy levels of solids. The Fermi-Dirac distribution, the Fermi energy. Intrinsic and extrinsic semiconductors, p-n junction.
13. Applications of the p-n junctions: Diodes, semiconductor rectifiers, transistor amplifiers, thyristors, integrated circuits.
14. Introduction to nuclear physics: Selected properties of atomic nuclei, radioactive decay, radioactivity, measurement of the dose rate. Model of the nuclear fission, nuclear reactor.

Subject Title: Fundamentals of Marketing Chemical Products

Semester: 3rd

Weekly Load and Assessment: 2/0/0 Ex

Credit: 3

Language: English

Course provider: Doc.Ing. Stanislava Grosová, CSc.

Annotation:

31. The role of marketing in organizations. Marketing management. Marketing strategy
32. Marketing environment – customers, competitors, trends in macroenvironment.
33. Consumer and Industrial markets. Industrial Buying Process.
34. Market segmentation and product positioning.
35. Brand management.
36. Product – quality, packaging, application services
37. New product development and market introduction
38. Price and pricing.
39. Distribution channels
40. Marketing communication. Public relations. Sales promotion.
41. Personal selling.
42. Sales force management.
43. Key account management.
44. Sales promotion. Public relations. Direct marketing.
45. Market intelligence.

Subject Title: Fundamentals of Editorial Work

Semester: 4th

Weekly Load and Assessment: 2/0/0 Ex

Credit: 3

Language: English

Course provider: Department of Polymers

Annotation:

1. Publications in Science and Technology, their types (general principles, structure, form, level, strategy)
2. Written documents and their types (short, standard a and long texts, other types of presentations)
3. Scientific and professional writing
4. Publishing house and its functioning (types of editing, author-publisher liaison)
5. Basic explanation of copyright rules and author law
6. Fundamental economics of publishing (assessment of market, production costs, prices, distribution and promotion)
7. Editing of the text I (language, style of the text, prelims)
8. Editing of the text II (chemical a mathematical texts)
9. Technical editing I (text style, paragraphing, headings, title pages)
10. Technical editing II (tables and illustrations)
11. Practical training with model texts
12. Introduction to typography I (standard and modern typographic techniques)
13. Introduction to typography II (processing of illustrations)
14. Visit in the publishing and printing houses

Subject Title: Chemical Engineering I

Semester: 4th

Weekly Load and Assessment: 2/3/0 c, Ex

Credit: 6

Language: English

Course provider: Department of Chemical Engineering

Annotation:

1. Basic concepts. Classification of systems. Fundamentals of balances. Balances of mass and molar amount.
2. Balances of energy, enthalpy and momentum. Bernoulli equation and equation of hydrostatics.
3. Flow of fluids through pipelines. Transport of fluids, pumps. Flow of fluids through the layer of granular material.
4. Filtration, types of filters, rate of filtration. Sedimentation, sedimentation velocity, sedimentation equipment.
5. Fluidization, fluidization equipment, description of fluidized bed reactor. Mixing, mixing equipment. Residence time.
6. Heat transfer by conduction, convection and radiation. Local and overall heat transfer. Heat transfer coefficients.
7. Heat exchangers: types of equipment and calculation of different types. Evaporators: types of equipment, balances. Crystallization.
8. Diffusion separation processes. Separators. Equilibrium stage.
9. Membrane separation processes, types of membranes and modules, driving forces, calculations of membrane modules.
10. Liquid-liquid extraction, extractors. One step, repeated and counter-current extraction.
11. Equilibrium and differential distillation of binary mixtures. Rectification of binary mixtures.
12. Absorption, types of absorbers, number of equilibrium stages, height of packed absorption column. Adsorption.
13. Drying of solids, enthalpy diagram of wet air, batch and continuous dryers.
14. Chemical reactors and bioreactors, basic types. Molar and enthalpy balances.

Subject Title: Toxicology

Semester: 4th

Weekly Load and Assessment: 2/0/0 Ex

Credit: 3

Language: English

Course provider: Department of Organic Chemistry

Annotation:

1. Toxicology, toxicity, intoxication, poison. Definition of the terms; position of toxicology among other sciences, brief history.
2. Dose and effect, toxic responses, intoxication. Acute *versus* chronic toxicity, local *versus* systemic effect, neurotoxicity, immunotoxicity, mutagenicity, teratogenicity, carcinogenicity, organ-directed toxicity.
3. Mechanisms of toxicity, the receptor theory, xenobiotics, their interactions with biologically important target molecules.
4. Fate of xenobiotics in the organism: absorption, distribution, biotransformation, excretion.
5. Biotransformation of xenobiotics and toxicity. Types of biotransformation reactions, detoxification, metabolic activation, biotransformation enzymes.
6. How to assess toxicity. Experiments *in vitro* and *in vivo*, computer models.
7. Searching the literature for toxic properties. Toxicological data (LD, LC, NOAEL, LOAEL, etc.) toxicologic databases, Material Safety Data Sheets
8. Structure and effect. Toxic effect as one of the compound properties, its assessment (SAR), scope and limitations.
9. Biological monitoring. Indicators of the dose and of the effect. Metabolites, protein adducts, DNA adducts.
10. Toxicity and risk. Physico-chemical properties of compounds as related to the ways of absorption into the organism; health and environmental risk.
11. Further risks arising from the manipulation with chemicals. Flammable compounds, explosive and pyrophoric compounds, characterisation of combustible matters.
12. Examples of frequently used toxic and hazardous compounds. Toxicological data, safety data, their interpretation.
13. Special classes of toxic compounds. Poisons of plant and animal origin, psychoactive compounds, warfare chemicals, ecotoxic compounds, biocides and pesticides.
14. Carcinogenic compounds, epigenetic carcinogens, possibilities of the assessment of carcinogenic potential based on the structure and biotransformation.

Subject Title: Analytical Chemistry I

Semester: 4th

Weekly Load and Assessment: 2/1/0 c, Ex

Credit: 4

Language: English

Course provider: Department of Analytical Chemistry

Annotation:

1. Analytical chemistry, its functions and applications
2. Solution equilibria, pH
3. Titrimetry, gravimetry
4. Electrochemical methods
5. Extraction, principles of chromatography
6. Principles of chromatography, gas chromatography
7. Liquid chromatography, capillary electrophoresis and electrochromatography
8. Principles, spectrometric instrumentation
9. Atomic spectrometry
10. Molecular spectrometry
11. Molecular spectrometry
12. Mass spectrometry, combined techniques
13. Thermogravimetry, sensors, automated procedures
14. Errors in analytical measurements Errors in analytical measurements

Subject Title: Applied Statistic

Semester: 4th

Weekly Load and Assessment: 1/2/0 c, Ex

Credit: 4

Language: English

Course provider: Department of Mathematics

Annotation:

1. Events and random experiment. Probability, calculus of events probability, combinatorial formulas. Conditional probability, independent events Bayes` s theorem.
2. Random variable, distribution of random variable. Distribution function definition and properties. Probability function and probability density.
3. Mean, variance, quartiles (quartiles, percentiles). Simple functions of random variable.
4. Multivariable random variables. Independence and Correlation of random variables. Covariance and correlation matrix.
5. Basic types of discrete probability distribution application examples.
6. Basic types of continuous probability distributions Normal (Gaussian) distribution, Log- normal distribution, Student t- distribution, F-distribution. Tables of distribution quantiles and manipulation with them.
7. Random sample, sample space, sample estimator of distribution parameters, sorted sample, histograms. Random sample of Normal distributions.
8. The point estimators of unknown distribution parameters. Interval estimation and basic principle of setting it up.
9. Testing a Statistical Hypothesis. Null and Alternative Hypothesis, testing criterion, Errors of I. and II. type, probability level of test p-value. One-sample tests
10. Two-sample testing. Circumstances and fitness of using in different situations.
11. The confirmation of actual type of distribution (particularly Normal distribution). Goodness of Fit test condition of using, examples.
12. Evaluation of mutual dependency of random variables. Independency test. Analysis of contingency table, examples.
13. Regression analysis, linear regression model. Point and interval estimation of regression curve parameters. Tests of this parameters, prediction and variability region of regression curve. Application examples.
14. Complementary and statistical methods concluding lecture.

Literature:

1. Pavlik J. at all : Sbirka prikladu z pravdepodobnosti a matematicke statistiky. VSCHT Prague, 1999. (in Czech)
2. Freund J.E., Walpole R.E.: Mathematical Statistics. III. ed. Prentice Hall Inc. Englewood Cliffs New Jersey 07632.

Subject Title: Informatics and Chemistry: Semestral Project III

Semester: 4th

Weekly Load and Assessment: 0/6/0 c

Credit: 6

Language: English

Course provider: Department of Polymers

Annotation:

1. Students will create multimedial study materials, explaining an ecological problems. Emphasis will be given to consistency of different parts of the presentation and user interfaces. Students will be acquainted with principals of distance education.

Subject Title: Environmental Protection Processes

Semester: 4th

Weekly Load and Assessment: 2/1/0 c,Ex

Credit: 4

Language: English

Course provider: Department of Organic Technology

Annotation:

1. Recycling and regeneration of raw materials, green chemistry
2. Typical waste sources, environmental assessment
3. Treatment of wastes from inorganic chemistry, exhalates
4. Solid inorganic wastes, solidification
5. Waste-water treatment
6. Membrane separation in electrical field
7. Electrolysis in environmental protection
8. Principles of sustainable chemical technology
9. Catalytic treatment of VOC
10. Chemical treatment of organics in process water
11. Advanced oxidation processes, ozonization
12. Fenton oxidation, secure operation
13. Wet oxidation of polluted water
14. Treatment process evaluation, engineering

Subject Title: Physical Chemistry II

Semester: 4th

Weekly Load and Assessment: 3/2/0 c, Ex

Credit: 7

Language: English

Course provider: Department of Physical Chemistry

Annotation:

15. Real behaviour of gases, liquids and their mixtures (virial and multiconstant equations of state, CS theory).
16. Application of the 1st law of thermodynamics, temperature and pressure dependence of state functions.
17. Consequences of the 2nd law of thermodynamics, efficiency of heat engines, heat pumps.
18. Irreversible processes, Joule-Thomson coefficient, inversion temperature, condensation of gases.
19. Energetics of chemical reactions, reaction heat and methods for its determination.
20. Spontaneous changes and Gibbs energy. Chemical equilibrium in real systems.
21. Yield of chemical reaction, decompositions of solid substances, simultaneous equilibria.
22. Theory of electrolytic dissociation, equilibria in electrolyte solutions, pH, solubility constants.
23. Equilibrium electrochemical cells, classification, cells as energy sources.
24. Phase equilibria in real binary systems (l-g, l-l, s-l). Colligative properties.
25. Ternary systems, Nernst distribution law, phenomena on phase boundaries.
26. Diffusion, migration of ions in electric field, conductivity, Kohlrausch law.
27. Kinetics of simultaneous reactions, reversible reactions and chemical equilibrium.
28. Mechanism of chemical reactions, photochemistry, catalysis.

Subject Title: Accounting

Semester: 4th

Weekly Load and Assessment: 2/2/0 c, Ex

Credit: 5

Language: English

Prerequisites:

Course provider: Department of Economics and Management

Annotation:

1. Relevancy of Accountancy.
2. Company Assets.
3. Accounting Statements.
4. Asset Pricing.
5. Circular flow of assets.
6. Methodical Accounting Principles
7. Accounting Standards.
8. Long Term Assets.
9. Current Assets.
10. Financial Assets.
11. Receivables.
12. Liabilities.
13. Equity and debts.
14. Annual Accounts

Subject Title: Informatics and Chemistry: Semestral Project IV

Semester: 5th

Weekly Load and Assessment: 0/6/0 c

Credit: 6

Language: English

Course provider: Department of Department of Chemical Engineering

Annotation:

1. The ecological project has two aims: independent solution of an ecological engineering problem and presentation of the obtained results at a student conference. Each student individually selects the theme of the project according to own decision. Student independently prepares a written report that includes the basic structure of a scientific and/or technical report, i.e., introduction, bibliographic search, methods and solution, conclusions, table of symbols, bibliographic citations etc. Students obtain the basic information about principles and the structure of the ecological project in the first week of the semester. Students select the theme of the project in the second week of the semester. The chosen strategy and preliminary results can be consulted with the teacher in the next weeks. Students defend the results of the project at the student conference in the last week. Each student prepares 10 minutes lecture and presents it for the teacher and the other students.

Subject Title: Chemistry and Data Processing: Laboratory

Semester: 5th

Weekly Load and Assessment: 0/0/4 c

Credit: 3

Language: English

Course provider: Department of Inorganic Chemistry

Annotation:

1. Bibliographical research
2. Sample preparation
3. Basic analytical operations
4. Measurement of selected parameters
5. Data processing

Subject Title: Chemical Engineering II

Semester: 5th

Weekly Load and Assessment: 2/3/0 c, Ex

Credits: 6

Language: English

Course provider: Department of Chemical Engineering

Annotation:

1. Fluid mechanics, equation of continuity, equations of motion, fluid flow in pipes.
2. Flow out of reservoirs – containers, hazards and safety. Centrifuges and cyclones.
3. Flow through beds of solids, pressure drop. Multi-phase flow.
4. Hydromechanical separations of dispersion systems. Kinetics of filtration. Settling.
5. Dispersion systems. Fluidization: quantitative description of fluidized bed. Bubble columns.
6. Dimensional analysis, dimensionless groups, correlations. Principles of modelling. Analogy.
7. Radiation heat transfer. Heat exchange in flowing fluids; cooling, heating and sterilization.
8. Convective and diffusive mass transfer. Mass exchange at interfaces.
9. Mass transfer: concepts of equilibrium-stage and diffusional processes.
10. Continuous rectification of binary and multi-component mixtures.
11. Membrane processes: gas permeation, reverse osmosis, pervaporation, ultrafiltration.
12. Continuous stirred tank reactor, cascades. Tubular reactor. Heterogeneous reactors. Reactors with nonideal flow.
13. Bioreactors, microorganism cultivation, growth and production. Fermentors, enzyme reactors.
14. Adsorption and chromatography. Crystallization from solutions. Crystallizers.

Subject Title: Analytical Chemistry II

Semester: 5th

Weekly Load and Assessment: 2/1/0 c, Ex

Credit: 4

Language: English

Course provider: Department of Department of Analytical Chemistry

Annotation:

1. Analytical chemistry in applications (requirements, techniques, examples)
2. Security
3. Criminalistics
4. Cultural heritage
5. Materials
6. Microcosmos
7. Foods
8. Processes
9. Sensors
10. Sport and household
11. Structure
12. Cosmos
13. Health
14. Environment

Subject Title: Safety and Legislation in Chemistry

Semester: 5th

Weekly Load and Assessment: 2/0/0 Ex

Credit: 3

Language: English

Course provider: Department of Inorganic Chemistry

Annotation:

1. Act on chemical substances and chemical preparations and on an amendment to certain other acts (356/2003)
2. Source of information to realization act 356/2003 – description single database, indices materials amenable registration
3. Material Safety Data Sheet (MSDS), R,S-phrases, packaging, labelling
4. Decree of the Government No 258/2001 Coll. – List of hazardous chemical substances and chemical preparations
5. Placing of selected hazardous substances and preparations on the market and putting them into circulation
6. General principles of the classification of substances and preparations- conventional calculation methods for evaluating the hazardous properties of preparations based on their physical and chemical features, hazardous to human health and hazardous to the environment.
7. Hazardous reactions of common chemical substances and chemical preparations
8. Hazardous substances, minimum concentrations of hazardous substances to be taken into account for classifications of substances and preparations, concentration limits for changes to the classification of hazardous preparations
9. First aid measures, after inhalation, skin contact, eye contact.....
10. Act on chemical substances and chemical preparations and on an amendment to certain other acts in practice
11. Law on the prevention of major accidents caused by selected chemical substances and chemical preparations in the wording of later regulations
12. Regulation (EC) No 761/2001 allowing voluntary participation by organisations in a Community eco-management and audit scheme
13. Act No 185/2001 on waste and amendment of some other acts
14. Preparations and productions of dangerous chemical substances and chemical preparations (Examples of explosives, oxidizer, highly inflammable, highly toxic etc.)

Subject Title: Ecological Informatics

Semester: 5th

Weekly Load and Assessment: 2/0/0 c

Credit: 2

Language: English

Course provider: Department of Polymers

Annotation:

1. Definitions, terminology and basic concepts
2. Taxonomy of species
3. Taxonomy of ecosystems
4. Databases of species and ecosystems
5. Ecological indicators, quantitative ecology
6. Ecological data in chemical databases
7. Ecological data on the Internet
8. International organizations and treaties
9. Czech legal system and norms
10. Scientific ecological journals and their terminology
11. Ecological journalism
12. Collection and processing of data for ecological risks evaluation
13. Statistics in ecology
14. Administration of portals with ecological focus

Subject Title: Scripting Languages

Semester: 5th

Weekly Load and Assessment: 2/2/0 c,Ex

Credit: 5

Language: English

Course provider: Department of Polymers

Annotation:

1. Basics of procedural programming
2. Python – basic syntax
3. Data types
4. Flow control – cycles, conditional statements
5. Basics of algorithmization
6. Custom function definition
7. Modules and libraries
8. Input and output
9. Object oriented approach
10. Regular expressions, text processing
11. Python and XML
12. Conventions and practical recommendations
13. Perl
14. PHP

Subject Title: Databases

Semester: 5th

Weekly Load and Assessment: 2/2/0 c, Ex

Credit: 5

Language: English

Course provider: Department of Chemical Engineering

Annotation:

1. Introduction. Examples of database and information systems. Problem scope - area of interest.
2. Mathematical background (relations, relational algebra, relational calculus).
3. Systematic development of database and information systems, degrees of formalization and abstraction.
4. Real world and the analyses of the area of interest. Gaining knowledge about data, information, dataflows, workflows, functions, states, decisions.
5. Conceptual design. Entities, occurrences of entities, attributes, domains, relations. ER diagrams, DF diagrams and other schemes for conceptual modeling. Modern tools for conceptual modeling, CASE systems.
6. Implementation design. Database models.
7. Relational databases. Normalization of data structures, normal forms. Integrity conditions.
8. Object oriented databases and their design.
9. Physical database implementation design. Implementation phase of a database or information system.
10. Environments for the development of database systems. Overview of environments under various operating systems (UNIX, Windows). Specialized database languages.
11. Development environments under OS Windows. MS Access, MS Visual FoxPro. Interactive work, programming.
12. Database languages SQL and 4GL.
13. Database servers and the architecture client-server. Particular database servers MySQL and MS SQL Server.
14. Utilization of database systems in computer networks with concurrent access. Principles of data protection and preservation of their consistency. Transaction processing. Dynamic and static data, snapshots, differential files.

References

1. Silberschätz, Galvin, Gagne: *Operating System Concepts*, 6th edition (Windows XP update), Wiley, 2003
2. Harrington J.L.: *Relational Database Design Clearly Explained*. Morgan Kaufmann, 2002
3. Howe D.: *Data Analysis for Database Design*. Elsevier, 2001
4. Vaněk T.: *Electronic version of lecture notes*.
5. Other sources according to the actual offer of monographs and other titles on the market.

Subject Title: Computer Graphics

Semester: 6th

Weekly Load and Assessment: 1/3/0 c, Ex

Credit: 5

Language: English

Course provider: Department of Computing and Control Engineering

Annotation:

1. Principles of graphics information acquisition, vector and raster computer graphics
2. Colours in computer graphics and their processing. Basic colour models, colour reduction
3. Survey of the most important graphics formats - their properties and usage
4. Basic methods of image processing, histogram and its usage
5. Advanced method of image processing (image segmentation, measurement in image, ...)
6. Individual project 1: Application of image processing methods
7. Principles of technical graphic document creation, introduction to the AutoCAD system
8. Basic objects of vector graphics and their properties (analytical given curves, text, ...)
9. Advanced objects of vector CG (spline curves, hatches, dimensions, ...)
10. Connection of the AutoCad system to other products (export, import, external references)
11. Individual project 2: Drawing of technical document
12. 3D modelling principles, methods of 3D models display
13. 3D graphics for WWW - introduction to VRML
14. Individual project 3: 3D model

Subject Title: Computer Graphics for Visualising the Structure of Molecules

Semester: 6th

Weekly Load and Assessment: 2/0/0 Ex

Credit: 3

Language: English

Course provider: Department of Chemistry of Solid State

Annotation:

1. The history of computer graphics
2. The key mathematic used in computer graphics
3. The possibilities of 2D data representation
4. Methods of manipulation with 2D images
5. Rendering and ray tracing methods
6. Existing software for molecular visualization
7. The basics of C programming language
8. HW accelerated graphics – the OpenGL basics principles
9. Typical coding approaches for molecular visualization
10. Existing HW for visualization
11. Stereoscopic visualization, VR based techniques
12. Animation techniques, video data processing
13. Volumetric data visualization – application for force field maps
14. Current trends in computer graphics

Literature

1. Mason W., a col.: OpenGL Programming Guide Third Edition, Massachusetts, Addison Wesley, 1999
2. James D. Foley, Andries van Dam, Steven K. Feiner, John F. Hughes:
3. Computer Graphics: Principles and Practice in C (2nd Edition)

Subject Title: Advanced Chemical Informatics

Semester: 6th

Weekly Load and Assessment: 0/3/0 c

Credit: 3

Language: English

Course provider: Department of Polymers

Annotation:

1. Chemical databases: CrossFire, SciFinder, Web of Science, specialized and Internet databases
2. Patents and grey literature: sources, objectivity, legal consequences
3. Structural searches: introduction to structural searches in major chemical databases
4. Physical properties: basic procedures for search of constants, temperature and pressure dependent properties, thermodynamic and thermochemical properties
5. Isomerism: properties and comparison of organic and inorganic isomers
6. Complexes: inorganic and organic complexes - preparations, solubility, spectral data
7. Chemical reactions: basic procedures in reaction searches
8. Project work I - a complex multifaced search
9. Biological, physiological and toxicological data - combining searches for discovery of biologically significant data
10. Engineering calculations - engineering data collection, evaluation and usage in basic calculations
11. Industrial processes: access to industrially significant publications and their evaluation
12. Ecological disasters and problems: collecting and evaluation of data
13. Preparation of materials for teamwork
14. Project work II: research of a current problem

Subject Title: Fundamentals of Programming in C

Semester: 6th

Weekly Load and Assessment: 2/2/0 c, Ex

Credit: 5

Language: English

Course provider: Department of Chemical Engineering

Annotation:

1. Introduction. History and significance of the C language. International standards. C and other programming languages.
2. Analysis of the problem solved. Analytical, implementation and testing phases of the program design. Programming environments and CASE systems.
3. The art of programming and programming technologies. Structured programming. Object oriented programming. Programming styles.
4. Syntax of the C language. Construction of a program in C. Header files. Compiler directives. Commonly accepted conventions.
5. Data types. Declarations and definitions. Operators and their priorities.
6. Pointers and their usage.
7. Program statements of the C language.
8. Functions in the C language.
9. Overview of standard C libraries and functions.
10. Functions for program input and output operations.
11. User-defined data types. Structures.
12. Dynamic memory allocation.
13. Strategy for the design of huge programs in C. Principles of teamwork.
14. Programming of scientific and technical applications in C.

References

1. Ackermann E.C.: *C Programming Language Essentials*. Research & Education Assoc., 2001, ISBN 0878916962.
2. Kernighan, B. W. -- Ritchie, D. M.: *The C Programming Language. Second Edition*. Prentice Hall 1988. ISBN 0-13-110362-8.
3. Vaněk T.: *Electronic version of lectures*.

Subject Title: Transmission and Processing of Information

Semester: 6th

Weekly Load and Assessment: 2/0/0 Ex

Credit: 3

Language: English

Course provider: Department of Solid State Engineering

Annotation:

1. Types of communication, communication line, transmission capacity.
2. Transmission channel, base parts requirements.
3. Signal definition, interference, modulation.
4. Electronic transmission, devices with high-speed communication velocity.
5. Optoelectronics transmission, bases of photonic.
6. Basic elements of optoelectronic transmission, light emitting diode, laser, photodiode.
7. Increasing of communication efficiency – integration.
8. Wireless transmission, frequency bands, transmitter.
9. Receiver, signal and noise, reception principle.
10. Digital transmission, parameters, coding.
11. Record and storage of data.
12. Measurement, transmission and collection of data.
13. Perspective transmission systems – satellite and mobile communication.
14. Radar technique, interception and searching systems.

Literature

1. Foit J.: Electronics. CTU Prague, 1999.
2. Weinstein S.: The multimedia internet. Plenum US, 2005.

Subject Title: Chemistry of the Environment

Semester: 6th

Weekly Load and Assessment: 3/0/0 Ex

Credit: 4

Language: English

Course provider: Department of Chemistry of Solid State

Annotation:

1. Introduction-global views; environmental bodies; anthropogenic influences
2. Atmosphere-zonal division
3. Stratosphere-chemistry of ozone
4. Chemistry of troposphere-precipitation; smog; atmospheric aerosol
5. Anthropogenic pollution in atmosphere; climate evolution
6. Hydrosphere-physical chemical properties of water; distribution of compounds in water systems
7. Gases and organic compounds in water; microorganisms
8. Metals in water systems
9. Surface chemistry; colloids
10. Contamination of aqueous systems and their regeneration
11. Geological foot and pedosphere
12. Soil chemistry
13. Chemistry of solid wastes and pesticides
14. Prognosis in environmental trends; situation in Europe

II.

SYLABY PŘEDMĚTŮ BLOKU MODULOVÉ VÝUKY

Subject Title: Toxicology and Ecology

Semester: 1st

Weekly Load and Assessment: 2/0/0 Ex

Credit: 3

Language: English

Course provider: Department of Organic Technology

Annotation:

1. Toxicology, its scope and basic principles
2. Historical background of modern Toxicology
3. The most common inorganic, herbal, animal, microbiological and fungi poisons
4. Xenobiotics – classification
5. Xenobiotics and their interactions with a living body
6. Biochemical effects of xenobiotics
7. Modes of intercellular communications
8. Biotransformation processes
9. Most common organic poisons (e.g. drugs)
10. Materials Safety Data Sheets
11. Exposure limits and safety rules, law regulations
12. Ecotoxicology
13. Toxicology and chemical industry

Literature: Lecture notes, a special text is now being prepared

Subject Title: Toxicology

Semester: 4th

Weekly Load and Assessment: 2/0/0 Ex

Credit: 3

Language: English

Course provider: Department of Organic Chemistry

Annotation:

1. Toxicology, toxicity, intoxication, poison. Definition of the terms; position of toxicology among other sciences, brief history.
2. Dose and effect, toxic responses, intoxication. Acute *versus* chronic toxicity, local *versus* systemic effect, neurotoxicity, immunotoxicity, mutagenicity, teratogenicity, carcinogenicity, organ-directed toxicity.
3. Mechanisms of toxicity, the receptor theory, xenobiotics, their interactions with biologically important target molecules.
4. Fate of xenobiotics in the organism: absorption, distribution, biotransformation, excretion.
5. Biotransformation of xenobiotics and toxicity. Types of biotransformation reactions, detoxification, metabolic activation, biotransformation enzymes.
6. How to assess toxicity. Experiments *in vitro* and *in vivo*, computer models.
7. Searching the literature for toxic properties. Toxicological data (LD, LC, NOAEL, LOAEL, etc.) toxicologic databases, Material Safety Data Sheets
8. Structure and effect. Toxic effect as one of the compound properties, its assessment (SAR), scope and limitations.
9. Biological monitoring. Indicators of the dose and of the effect. Metabolites, protein adducts, DNA adducts.
10. Toxicity and risk. Physico-chemical properties of compounds as related to the ways of absorption into the organism; health and environmental risk.
11. Further risks arising from the manipulation with chemicals. Flammable compounds, explosive and pyrophoric compounds, characterisation of combustible matters.
12. Examples of frequently used toxic and hazardous compounds. Toxicological data, safety data, their interpretation.
13. Special classes of toxic compounds. Poisons of plant and animal origin, psychoactive compounds, warfare chemicals, ecotoxic compounds, biocides and pesticides.
14. Carcinogenic compounds, epigenetic carcinogens, possibilities of the assessment of carcinogenic potential based on the structure and biotransformation.

Subject Title: Safety in Chemical Production

Semester: 6th

Weekly Load and Assessment: 2/1/0 c,Ex

Credit: 4

Language: English

Course provider: Department of Organic Technology

Annotation:

1. Structure of hazard in production and application of chemicals
2. Sources of hazard in chemical plants
3. Risk analysis: examples of typical sources of hazard in chemical plants
4. Processes involving compressed gases, liquefied gases and overheated liquids
5. Toxic and eco-toxic substances
6. Registers of releases and transfers of dangerous substances
7. Static electricity as a source of hazard
8. Exothermic chemical reactions as a source of hazard
9. Dangerous processes involving exothermic chemical reactions
10. Safe control of exothermic chemical reactions
11. Hazards in treating explosive and flammable substances
12. Case studies: explosive and flammable substances
13. Information system for transport of dangerous chemical substances
14. Information sources and databases, communication with the public

Subject Title: Environmental Protection Processes

Semester: 4th

Weekly Load and Assessment: 2/1/0 c,Ex

Credit: 4

Language: English

Course provider: Department of Organic Technology

Annotation:

1. Recycling and regeneration of raw materials, green chemistry
2. Typical waste sources, environmental assessment
3. Treatment of wastes from inorganic chemistry, exhalates
4. Solid inorganic wastes, solidification
5. Waste-water treatment
6. Membrane separation in electrical field
7. Electrolysis in environmental protection
8. Principles of sustainable chemical technology
9. Catalytic treatment of VOC
10. Chemical treatment of organics in process water
11. Advanced oxidation processes, ozonization
12. Fenton oxidation, secure operation
13. Wet oxidation of polluted water
14. Treatment process evaluation, engineering

Subject Title: Chemical and Physical Principles of Buildings Sanitation

Semester: 6th

Weekly Load and Assessment: 2/0/0 Ex

Credit: 3

Language: English

Course provider: Department of Chemical Technology of Monument Conservation

Annotation:

1. Clay materials and their properties, adobe.
2. Brick and roof tiles and their properties
3. Lime and its properties
4. Plaster and its properties
5. Cement and its properties
6. Mortars and their composition, structure and properties
7. Coat and their composition, structure and properties
8. Special coat, principles and properties
9. Surface finishing of fasade, materials and their properties
10. Lime paint, cement paint, silicate paint etc.
11. Fasade cleaning
12. Mechanism of ageing and corrosion of building materials
13. Possibilities of consolidation and conservation of damaged building materials
14. Methodical approach to reconstruction and conservation of historic buildings

Literatura

6. Torraca G.: Poröse Baustoffe , ICCROM 1986,
7. Weber H. a spol.: Fassadenschutz und Bausanierung, Expert Verlag, SRN 1994
8. Ashurst, J., Ashurst, N.: Practical Building Conservation - Heritage Technical Handbook - Mortars, Plasters and Renders, Alderhot, Gower Technical Press, 1988
9. Ashurst, J., Dinus, F.G.: Conservation of Building and Decorative Stone - volume 1 and 2, Butterworth – Heinemann, 1990
10. Coburn, A., Dudley, E., Spence, R.: Gypsum plaster - Its manufacture and use, Intermediate Technology Publications, London 1989

Subject Title: Safety Legislation in Chemistry

Semester: 5th

Weekly Load and Assessment: 2/0/0 Ex

Credit: 3

Language: English

Course provider: Department of Inorganic Chemistry

Annotation:

1. Act on chemical substances and chemical preparations and on an amendment to certain other acts (356/2003)
2. Source of information to realization act 356/2003 – description single database, indices materials amenable registration
3. Material Safety Data Sheet (MSDS), R,S-phrases, packaging, labelling
4. Decree of the Government No 258/2001 Coll. – List of hazardous chemical substances and chemical preparations
5. Placing of selected hazardous substances and preparations on the market and putting them into circulation
6. General principles of the classification of substances and preparations- conventional calculation methods for evaluating the hazardous properties of preparations based on their physical and chemical features, hazardous to human health and hazardous to the environment.
7. Hazardous reactions of common chemical substances and chemical preparations
8. Hazardous substances, minimum concentrations of hazardous substances to be taken into account for classifications of substances and preparations, concentration limits for changes to the classification of hazardous preparations
9. First aid measures, after inhalation, skin contact, eye contact.....
10. Act on chemical substances and chemical preparations and on an amendment to certain other acts in practice
11. Law on the prevention of major accidents caused by selected chemical substances and chemical preparations in the wording of later regulations
12. Regulation (EC) No 761/2001 allowing voluntary participation by organisations in a Community eco-management and audit scheme
13. Act No 185/2001 on waste and amendment of some other acts
14. Preparations and productions of dangerous chemical substances and chemical preparations (Examples of explosives, oxidizer, highly inflammable, highly toxic etc.)

Subject Title: Application of Computer Science

Semester: 1st

Weekly Load and Assessment: 0/3/0 c

Credit: 3

Language: English

Course provider: Department of Computing and Control Engineering

Annotation:

1. Information technology, computer architecture, operational systems principles
2. Computer networks, Internet fundamentals, e-mail
3. Text editor fundamentals, basic functions, styles
4. Technical writing, formulas, equations and tables
5. Computer graphics fundamentals, formats, graphic object inserting
6. Spreadsheets, formulas and functions applications
7. Graphics in spreadsheets, worksheets, functions survey
8. Data transfer in spreadsheets and text editors, tables and graphs export
9. Technical applications of spreadsheets, data files processing
10. Database operations, data classification in spreadsheets, information filtering
11. File transfer, data import to spreadsheets, data export
12. Numeric and graphical processing of a real data in spreadsheets
13. Information systems integration, files administration
14. Student individual project using PC

Subject Title: Computer Graphics

Semester: 6th

Weekly Load and Assessment: 1/3/0 c, Ex

Credit: 5

Language: English

Course provider: Department of Computing and Control Engineering

Annotation:

1. Principles of graphics information acquisition, vector and raster computer graphics
2. Colours in computer graphics and their processing. Basic colour models, colour reduction
3. Survey of the most important graphics formats - their properties and usage
4. Basic methods of image processing, histogram and its usage
5. Advanced method of image processing (image segmentation, measurement in image, ...)
6. Individual project 1: Application of image processing methods
7. Principles of technical graphic document creation, introduction to the AutoCAD system
8. Basic objects of vector graphics and their properties (analytical given curves, text, ...)
9. Advanced objects of vector CG (spline curves, hatches, dimensions, ...)
10. Connection of the AutoCad system to other products (export, import, external references)
11. Individual project 2: Drawing of technical document
12. 3D modelling principles, methods of 3D models display
13. 3D graphics for WWW - introduction to VRML
14. Individual project 3: 3D model

Subject Title: Internet Publishing

Semester: 1st

Weekly Load and Assessment: 2/2/0 c, Ex

Credit: 5

Language: English

Course provider: Department of organic technology

Annotation:

1. Introduction – web servers and web browsers
2. HTML – basic page structure
3. HTML – basic constructions, data transfers via FTP
4. HTML - forms
5. CSS
6. CSS vs. HTML comparison
7. JavaScript - basics
8. Graphical data and multimedia - formats (GIF, PNG, JPEG), usage
9. Usability - homepage
10. Usability - navigation, search, JavaScript
11. Usability – web design for handicapped users (lowered sight or movement capabilities, older persons, etc.)
12. Anonymity of internet users, personal data protection, spam
13. Legal and moral aspects - quotation, referring, responsibility for published content
14. Presentation of created projects

Subject Title: Chemical Informatics

Semester: 2nd

Weekly Load and Assessment: 0/2/0 c

Credit: 2

Language: English

Course provider: Department of Physics and Measurements

Objective of the course (expected learning outcomes and competences to be acquired)

Students will get overall understanding of basic principles of communication of scientific knowledge, their distribution, archiving and searching. The aim of the course is to provide students with practical skill in working with information based on standard principles and structures with modern information technologies

Prerequisites

Basic skill in using computers and network communication is expected

Course contents

1. Information as physical and social concept and its specific meaning in science.
2. Mechanism of distribution, storage, and searching of scientific information
3. Analysis, classification and indexing of scientific publications
4. Modern information technologies and their impact on work-up of scientific publication.
5. Concept of scientific databases, different types, structures and usage.
6. General strategy of databases usage, technical and economic aspects.
7. Specific situation in chemistry and some other branches of natural science.
8. Libraries, their organization and usage in past and in present times.
9. Chemical Abstracts as fundamental and indispensable information source for all chemistry disciplines.
10. Chemical compound and its structure as key element of chemical information.
11. Representation of chemical structures in digital form, structure and reaction databases.
12. Patent as specific form of technical and scientific information, patent databases and other aspects of patent information.
13. Toxicological, environmental, biotechnological and other kind of information related to chemistry.
14. Assessment of present situation in chemical information and its perspectives Language of instruction Czech/English

Subject Title: **Data Acquisition and Data Treatment**

Semester: 5th

Weekly Load and Assessment: 1/2 /0 c, Ex

Credit: 4

Language: English

Course provider: Department of Organic Technology

Annotation:

1. Measurements in technical practice - objectives, design and evaluation, documentation.
2. Properties of industrial and laboratory data.
3. Measurements of basic quantities, systems of units, dimensions.
4. Estimation of physicochemical data, data sources in chemical informatics.
5. Data acquisition from mathematical models of chemical processes.
6. Simulation programs of chemical processes.
7. Statistical data handling, examples.
8. Statistical data analysis software, data plotting.
9. Data acquisition by means of mathematical models, principles of modelling.
10. Mechanistic model building, characteristics, practical utilisation.
11. Empirical model selection, characteristics, practical utilisation.
12. Parameter estimation methods, non-linear, multivariable and multiresponse regression, software.
13. Evaluation of regression analysis quality, reliability of regression parameters.
14. Experimental design for regression.

Subject Title: Databases

Semester: 5th

Weekly Load and Assessment: 2/2/0 c, Ex

Credit: 5

Language: English

Course provider: Department of Chemical Engineering

Annotation:

1. Introduction. Examples of database and information systems. Problem scope - area of interest.
2. Mathematical background (relations, relational algebra, relational calculus).
3. Systematic development of database and information systems, degrees of formalization and abstraction.
4. Real world and the analyses of the area of interest. Gaining knowledge about data, information, dataflows, workflows, functions, states, decisions.
5. Conceptual design. Entities, occurrences of entities, attributes, domains, relations. ER diagrams, DF diagrams and other schemes for conceptual modeling. Modern tools for conceptual modeling, CASE systems.
6. Implementation design. Database models.
7. Relational databases. Normalization of data structures, normal forms. Integrity conditions.
8. Object oriented databases and their design.
9. Physical database implementation design. Implementation phase of a database or information system.
10. Environments for the development of database systems. Overview of environments under various operating systems (UNIX, Windows). Specialized database languages.
11. Development environments under OS Windows. MS Access, MS Visual FoxPro. Interactive work, programming.
12. Database languages SQL and 4GL.
13. Database servers and the architecture client-server. Particular database servers MySQL and MS SQL Server.
14. Utilization of database systems in computer networks with concurrent access. Principles of data protection and preservation of their consistency. Transaction processing. Dynamic and static data, snapshots, differential files.

Subject Title: Toxic Effects of Chemical Substances and Legislation

Semester:

Weekly Load and Assessment:

Credit:

Language: English

Course provider: Department of inorganic technology

Annotation

1. REACH system – Registration, Evaluation and Autorisation of Chemicals
2. Act on chemical substances and chemical preparations and on an amendment to
3. certain other acts (345/2005).
4. Scientific and Technical Information Network – STN International
5. Notification of new chemicals – xx/zzz/EHS
6. Material Safety Data Sheet (MSDS), R,S-phrases, packaging, labelling.
7. Decree of the Government No 369/2005Coll. – List of hazardous chemical substances
8. and chemical preparations.
9. Placing of selected hazardous substances and preparations on the market and putting
10. them into circulation.
11. General principles of the clasification of substances and preparations- conventional calculation methods for evaluating the hazardous properties of preparations based on their physical and chemical features, hazardous to human health and hazardous to the environment.
12. Health effects. First aid measures, after inhalation, skin contact, eye contact.
13. Biocide (Act No 120/2002) and Detergents (ES No 648/2004)
14. Hazardous substances, minimum concentrations of hazardous substances to be taken into account for classifications of substances and preparations, concentrtrion limits for changes to the classification of hazardous preparations.
15. Land transport ADR 2005
16. Regulation (EC) No 761/2001 allowing voluntary participation by organisations in a Community eco-management and audit schneme.
17. Act No 185/2001 on waste and amendment of some other acts.

Rozvojový projekt Internacionalizace výuky chemicko-inženýrských oborů v roce 2005 na FCHT VŠCHT Praha byl zpracován pod vedením proděkana pro zahraničí a styk s průmyslem FCHT VŠCHT Praha Doc.Ing. Alešem Helebranta, CSc., proděkanky pro pedagogiku FCHT VŠCHT Praha Doc.Ing. Olgy Smrčkové, CSc.; s konzultační pomocí Doc.Ing. Jiřího Havrdy, CSc.

Vypracovala: Ing. Jana Andertová, CSc.
Praha, leden 2006