Faculty of Chemical Technology and Biotechnology

IMPORTANT NOTES

If for one subject you can find several different types (lecture, practice, laboratory) of courses then please choose one and only one course from each type in order to be able to perform the subject's requirements successfully.Civil Engineering courses are on the website seperately. Courses chosen from the offer of Faculty of Civil Engineering will be checked and arranged individually by the departmental coordinator.

Subject code	Subject name	Requirement	ECTS credit
BMEVEFAA409	Colloid Chemical Approach to Nanotechnology	Mid-semester mark	3

Course type	Course code	Course language	Timetable information
Lecture	A0-ER	English	TUE:14:15-17:00(F1MFK);

Short history of colloid chemistry: from colloids to nanotechnology. Classification of colloid systems. Interfaces, surface tension. Curved surfaces, capillarity. Surface tension of solutions. Adsorption, adsorbents. Solution of macromolecules. Micelles and membranes. Biological aspects of colloids. Dispersions, micro- and macroemulsions, foams. Particle size measurements. Colloid stability. Rheology. Colloids in Nanotechnology

Subject code	Subject name	Requirement	ECTS credit
BMEVEFAM110	Materials science: traditional structural materials and polymers	Exam	4

Course type	Course code	Course language	Timetable information
Laboratory	16A_lab	English	MON:14:15-18:00(HF4);
Lecture	16A	English	WED:15:15-17:00(HF4);

Subject code	Subject name	Requirement	ECTS credit
BMEVEFKA304	Physical Chemistry I	Exam	5

Course type	Course code	Course language	Timetable information
Lecture	A0-ER	English	MON:08:15-10:00(F11Schay); WED:08:15-10:00(F11Schay);
Practice	A1-ER	English	MON:08:15-10:00(F11Schay); WED:08:15-10:00(F11Schay);

Thermodynamics: Characterization of thermodynamic systems. Internal energy, the first law of thermodynamics. Enthalpy, thermochemistry. Ideal and real gases. Entropy, the second law of thermodynamics. Gibbs free energy and Helmoltz free energy. One component phase equilibria. Thermodynamics of solutions, the chemical potential. Two component liquid-vapor and solid-liquid equilibria, phase diagrams. Distribution equilibrium. Chemical equilibrium.

Subject code	Subject name	Requirement	ECTS credit
BMEVEKFA403	Environmental Chemistry and Technology	Exam	4

Course type	Course code	Course language	Timetable information
Lecture	english-ER	English	THU:14:15-17:00(F211);

Elements of the environment, dangerous factors. The process of pollution: emission, transmission, imission. The aim and the instruments of environmental protection. Technical solutions. Economical instruments, fees, fines, supports. Air polluting materials (carbonmonoxide, nitrogen oxides, sulfur oxides, ozone, hydrocarbons, photochemical oxidants, particulates, dioxins, water polluting materials (materials with high oxygen demand, detergents, mineral oils, organic compounds, inorganic compounds, chemistry of their formation, parameters influencing their rate of formation, their chemical and physical interaction with the atmosphere, hydrosphere, litosphere and biosphere. Biologycal degradation of polymers. Heat pollution. Techniques of air and water pollution control. Classification of wastes, dangerous wastes, treatment and disposal technologies.

Subject code	Subject name	Requirement	ECTS credit
BMEVEKFM104	Modern Separation Technologies	Mid-semester mark	3

Course type	Course code	Course language	Timetable information
Laboratory	eng_pract_ER	English	THU:14:15-16:00(F211);
Lecture	theory+prac_ER	English	THU:14:15-17:00(F211);

Subject code	Subject name	Requirement	ECTS credit
BMEVEKFM105	Chemical Process Design and Control	Mid-semester mark	3

Course type	Course code	Course language	Timetable information
Lecture	eng_ER	English	TUE:10:15-12:00(F211);

Chemical process synthesis and analysis, levels of chemical process design, batch vs. continous systems, input-output structure, reactor system, recycling system, separation systems, heat exhanger network, pinch technology, flowsheeting and flowsheeting softwares, advanced process control system, control structure design, selective control, examples for design and controls, individual computer aided process design.

Subject code	Subject name	Requirement	ECTS credit
BMEVEKFM501	Environmentally Benign Chemical Processes	Exam	4

Course type	Course code	Course language	Timetable information
Lecture	eng_ER	English	WED:11:15-14:00(CH307);

Subject code	Subject name	Requirement	ECTS credit
BMEVEMBM301	Biology, biotechnology	Mid-semester mark	3

Course type	Course code	Course language	Timetable information
Lecture	A6	English	WED:14:15-16:00(CH305);

1. Introduction, special features of biotech: de novo fermentations and biotransformations. 2. Cell biology summary: cell structure and function 3. Microbiology and physiology survey: kinds of industrial microorganisms, their biochemistry: aerobes eacute;s anaerobes, basic microbial metabolic paths. 4. Introduction to enzyme engineering. 5. Techniques and unit operations applied in bioindustries: cultivation methods of microorganisms, culture media, sterilization, bioreactors: mass transfer. 6. Special methods of product isolation and purification: cell homogenization, affin (biocpecific) methods. 7. Some examples in white and green biotechnology: ethanol, citric acid, lactic acid fermentations, etc., biotransformations (semisynthetic antibiotics, enzymatic resolution methods) 8. Biotechnological waste water treatments:removal of organic materials, removal of phosphorus and nitrogen.

Subject code	Subject name	Requirement	ECTS credit
BMEVESAA208	Inorganic Chemistry	Mid-semester mark	3

Course type	Course code	Course language	Timetable information
Lecture	A8-ER	English	WED:13:15-16:00(CHFSEKÖ);

Reactions and properties of elements and their major compounds; Qualitative inorganic analysis: detecting the most important cations and anions: alkaline metals (Li+, Na+, K+); alkaline earth metals (Mg2+, Ca2+, Sr2+, Ba2+); boron group (BO33ndash;, Al3+); carbon group (CO32-, HCO3ndash;, SiO32ndash;, Sn2+, Sn4+, Pb2+); nitrogen group (NH4+, NO2ndash;, NO3ndash;, PO43ndash;, As3+, As5+); oxygen group (OHndash;, S2ndash;, SO32ndash;, SO42ndash;); halogens (Fndash;, Clndash;, Brndash;, Indash;); some transition metal ions (Cr3+, Mn2+, Fe2+, Fe3+, Ni2+, Cu2+, Zn2+, Ag+, Cd2+, Hg2+, Hg22+); Analytical system of Fresenius and Bunsen, analysis of mixed cations, mixed anions, mixed compounds, and polluted compound

Subject code	Subject name	Requirement	ECTS credit
BMEVESAA403	Analytical Chemistry Laboratory Practice	Mid-semester mark	4

Course type	Course code	Course language	Timetable information
Laboratory	A10L	English	WED:14:15-18:00(CHFLAB);
Lecture	A10E	English	WED:14:15-18:00(CHFLAB);

Gravimetric and titrimetric (acid-base, argentometry, complexometry, redoxi) determinations of different inorganic ions and organic compounds. Determination of inorganic and organic compounds using various instrumental analytical (potentiometry, conductometry, liquid-, gas- and thin layer chromatography, flame photometry, atomic absorption spectrometry, fluorimetry, ultraviolet/visible spectroscopy,) methods.Gravimetric and titrimetric (acid-base, argentometry, complexometry, redoxi) determinations of difinorganic ions and organic compounds. Determination of inorganic and organic compounds using various instrumental analytical (potentiometry, conductometry, liquid-, gas- and thin layer chromatography, flame photometry, atomic absorption spectrometry, fluorimetry, ultraviolet/visible spectroscopy,) methods. Literature: Skog D.A., West D. M., Holler F. J.: Fundamentals of Analytical Chemistry.5th Edition, Sounders College Publishing, New York, USA, 1988. Willard H. H., Merritt L. L., Dean J. A., Settle F. A.: Instrumental Methods of Analysis. 7th. Edition, Wadsworth Publ. Comp., Belmont, California, USA, 1988. Lecture material in electronic form ravand titrimetric (acid-base, argentometry, complexometry, redoxi) determinations of different inorganic ions and organic compounds. Determination of inorganic and organic compounds using various instrumental analytical (potentiometry, conductometry, liquid-, gas- and thin layer chromatography, flame photometry, atomic absorption spectrometry, fluorimetry, ultraviolet/visible spectroscopy,) methods. Gravimetric and titrimetric (acid-base, argentometry, complexometry, redoxi) determinations of difinorganic ions and organic compounds. Determination of inorganic and organic compounds using various instrumental analytical (potentiometry, conductometry, liquid-, gas- and thin layer chromatography, flame photometry, atomic absorption spectrometry,

fluorimetry, ultraviolet/visible spectroscopy,) methods.

Subject code	Subject name	Requirement	ECTS credit
BMEVESAM101	Complex and Inorganic Chemistry	Mid-semester mark	2

Course type	Course code	Course language	Timetable information
Lecture	A9-ER	English	TUE:14:15-16:00(CH306);

The subject provides an overview about organometallic chemistry and application of organometallic compounds. It discusses the special properties of orgamometallic compounds (different from those of classical inorganic and organic compounds) and their role in applications as chemical reagents and catalysts. It discusses the basics of homogen catalysis and the mechanism of industrial homogen catalytic processes.The organometallic chemistry of the following elements is discussed in detail: Li, Mg, Al, Sn, Ti, Cr, Fe, Co, Ni, Cu, Zn, Rh, and Pd. Discussion involves stability, structure, synthesis, physical and chemical properties, characteristic reactions, and application (industrial and laboratory). Short syllabus of the subject: History of organometallic chemistry. Definitions. Grouping of organometallic compounds. General properties of organometallic compounds. Synthesis of organometallic compounds. Characteristic reactions. Homogen catalysis. Synthesis, structure and characteristic reactions of Li- and Mg-organic compounds (substitution and addition reactions, metalation and transmetalation, catalytic reactions). Synthesis, structure and characteristic reactions of Al-organic compounds (polymer catalyst, Ziegler-Natta catalyst, synthesis of alpha;-olefins and alpha;-alcohols, olefin dimerization, preparation of organometallic compounds, preparation of high purity inorganic materials). Sn-organic compounds: synthesis, structure, and characteristic reactions (hydrostannation, hydrostannolysis, radical reactions, organostannylenes, redistribution reactions). Application as polymer catalyst, stabilizer, curing agent, and pharmaceutical. Ti-organic compounds: synthesis and characteristic reactions (substitution and insertion reactions of alkines, reactions of aldehydes and ketones, reductiv coupling and elimination with Ti-organic compounds, polymer catalysts). Cr-organic compounds: synthesis, characteristic reactions, substitution reactions, reactions on the organic ligand, rections of carben complexes. Fe-organic compounds: synthesis, characteristic reactions, Friedel-Crafts acylation, Mannich reaction, metalation, cyclization, polymerization. Co-organic compounds: synthesis, characteristic reactions, cyclization of acetylenes and olefins, Pauson-Khand reaction, carbonylations. Rh-organic compounds: synthesis, characteristic reactions, hydrogenations, hydrometalations, decarbonylations, carbonylations, hydroformylations, cyclizations. Ni-organic compounds: sysnthesis, characteristic reactions, substitution reactions, carbonylation, oligomerization of unsaturated hydrocarbons, catalytic reactions, coupling reactions with organic halides. Pd-organic compounds: synthesis, characteristic reactions, insertions, cyclic dimerizations, oxidative reactions with Pd(II),catalysts, Wacker process, reactions with Pd(0) catalysts, coupling reactions, Heck arylation, cyclization and carbonylation, cascade reactions. Cu- and Zn-organic compounds: sysnthesis, characteristic reactions (substitution, addition and transmetalation).

Subject code	Subject name	Requirement	ECTS credit
BMEVESAM301	Computational Chemistry	Exam	3

Course type	Course code	Course language	Timetable information
Lecture	A7-ER	English	MON:09:15-12:00(CHFGEP);

Aim of the subject: The subject gives an overview about the principles used to describe the structure of molecules and bulk phases. The modeling of physico-chemical parameters, chemical processes will be presented together with the usual techniques. Solution of practical problems by computer modeling. Short syllabus of the subject: 1./ Basic principles of quantum mechanics: The axioms, the hydrogen atom, the Born-Oppenheimer approximation, the independent particle model, and the MO theory. Hyerarchy of the theoretical models: Molecular mechanics, semiempirical, Hartree-Fock and post HF methods. Oniom and QM-MM methods. Density functional methods. The concept of the electron density. 2./ Application possibilities. Energy and electronic structure of atoms and molecules. Computation of measures related to physico-chemical or chemical concepts. Molecular geometry, conformation, conformational space. Modeling chemical reactions, thermodynamics and transition structures. Large systems, solutions and crystal structures. Molecular dynamics.

Subject code	Subject name	Requirement	ECTS credit
BMEVESTA411	Organic Chemical Technology	Exam	3

Course type	Course code	Course language	Timetable information
Lecture	24a	English	MON:10:15-12:00(F2M012);

The subject shows the typical fields, equipment and transformations of the organic chemical industry. The relevant fields discussed are: C1-, C2- and C3- intermediates, as well as aromatic substrates; detergents, washing powders and environmental considerations; pesticides, such as insecticides, fungicides and herbicides, toxicity and environment; features of the pharmaceutical industry, typical syntheses and technologies illustrated by the examples of some drugs selected; principles of green chemistry, environmental-friend considerations; characteristics of the plastic and rubber industry, recycling of thermoplastics; the textile and dye industry, natural and synthetic dyes.

Subject code	Subject name	Requirement	ECTS credit
BMEVESZA403	Medicines	Exam	3

Course type	Course code	Course language	Timetable information
Lecture	06a	English	TUE:08:15-10:00(F2M012);

The subject gives a breaf introduction to the medicinal chemistry and pharmacology. The fundamental pharmacological definitions and ideas as well as a historical outline of drug discovery and design are presented. Selected examples of drug action at some common target areas demonstrate the importance of the special receptor-drug interactions and the improtance of chemical modifications of the leading molecules to produce highly selective medicines. Typical examples are also discussed for drug metabolism including several organic chemicals and solvents which are important for the organic chemists.

Subject code	Subject name	Requirement	ECTS credit
BMEVEVMA504	Chemical Process Control	Mid-semester mark	5

Course type	Course code	Course language	Timetable information
Lecture	theor_ER	English	TUE:14:15-16:00(F211);
Practice	prac_ER	English	THU:12:15-14:00(DFcsarnok);

Aims of the chemical process control. Areas and methods of process control, feed forward control, feed back control. Mathematical basics, dynamic behaviours. Transfer function, frequency function. Model and modelling of chemical units and process from control point of view. Stability, its definitions in time, frequency, and Laplace domain. Controllers, controller algorithms, different controls and their characterizations. Controller tuning. Actuators, control valves. Basic controls: level, flow, pressure, temperature controls. Cascade controls. Control of multivariable processes. Interaction among control loops. Examples and solutions for the control of chemical units and processes.

Subject code	Subject name	Requirement	ECTS credit
BMEVEVMA607	Environmental Benign Chemical Process	Exam	4

Course type	Course code	Course language	Timetable information
Lecture	english_ER	English	WED:11:15-14:00(CH307);

Green chemistry metrics: The concepts of green chemistry, green engineering and sustainability. The necessity of quantifying a green reaction/process/product/firm. E factor, EQ factor, CI. Atom selectivity, atom efficiency, stoechiometric factor, conversion, reaction mass efficiency, material recovery parameter. Metrics to be applied for a process/production: mass index; energy factors: life cycle, waste treatment, solvent recovery; intensity factors: solvent, waste, energy; Emission control ndash;Example: Gas purification: Regulation aspects, Best available technology concept, Nitric acid production, environmental considerations in process development; Processes under vacuum: Sublimation, Freeze drying, lyophilization, Evaporation under vacuum, Short-path distillation, Molecular distillation; High-pressure processes: High-pressure distillation, Pressure-sensitive distillation (breaking azeotropes), High pressure processing of food; Supercritical fluid extraction and other processes: Supercritical fluids, properties, Solubility in supercritical fluids, Supercritical fluid extraction and fractionation, Chemical and biochemical reactions in supercritical fluids, Particle formation (crystallization) using supercritical fluids, Supercritical fluid chromatography; Biofuels (raw materials, by-products): Bioethanol, Biodiesel: trans-estherification; gasification; Fischer ndash; Tropsch synthesis, Biogas: hydrolysis; fermentation/digestion; purification; Recovery of organics from water: Separation of ethanol: azeotropic distillation, extractive distillation, liquid-liquid extraction, adsorption, membrane separations; Separations in fine chemical ndash; biochemical industry: Aqueous biphasic extraction, Chromatographic techniques (size exclusion, ion-exchange), Example: IgG purification from a fermentation broth.