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
BMEVEBEA301	Biochemistry	Exam	4

Course type	Course code	Course language	Timetable information
Lecture	A8	English	MON:15:15-18:00(CH306)

Principles of bioenergetics. Enzymes. Energy sources and main metabolic pathways of living organisms. Carbohydrate metabolism. Lipid metabolism. Protein and amino acid metabolism. Metabolism of nucleotides. Integration of metabolism. Generation and storage of metabolic energy. Citric acid cycle. Genetic information (storage, transmission and expression). The central dogma of molecular biology. Alcohol and drug metabolism. The regulation of metabolic pathways.

Subject code	Subject name	Requirement	ECTS credit
BMEVEFAA306	Plastics	Mid-semester mark	5

Course type	Course code	Course language	Timetable information
Laboratory	laboratory-ER	English	FRI:13:15-17:00(HF4)
Lecture	theory-ER	English	MON:12:15-14:00(HF2)

Definitions, classes of plastics, most important properties. Radical polymerization. Polycondensation, cross-linked polymers. Models of polymer physics. Polymer solutions. Phases and physical states. Behaviour of solid polymers, rubber elasticity. Uniaxial deformation, tensile testing, necking. Fracture, brittle and ductile failure. Relationship of molecular and macroscopic structure. Crystalline polymers. Melting, crystallization, polymorphism. Correlation between crystalline structure and properties. Structure of amorphous polymers. Polymer blends and composites. Physical states and processing modes. Machining. Application of plastics. Type and cause of degradation. Types of additives. Plastics and the environment. Plastics based on natural resources. Biodegradable polymers. Lab practice demonstrating the most important processing technologies and quality control methods.

Subject code	Subject name	Requirement	ECTS credit
BMEVEFAA405	Physical Chemistry II	Exam	4

Course type	Course code	Course language	Timetable information
Lecture	A6-ER	English	THU:08:15-11:00(F1MFK)
Practice	A7-ER	English	THU:08:15-11:00(F1MFK)

Reaction kinetics: Homogeneous reactions. First order and second order reactions. Equilibrium reactions. Consecutive and parallel reactions. Temperature dependence of reaction rates. Kinetics of heterogeneous reactions. Transport processes: Thermodynamic driving forces. Laws of diffusion. Heat conductance. Viscosity. Electrochemistry: Equilibrium in electrolytes. Thermodynamics of galvanic cells. Electrode potentials. Conductivity of electrolytes. Kinetics of electrode processes.

Subject code	Subject name	Requirement	ECTS credit
BMEVEFAA506	Physical Chemistry Laboratory Practice	Mid-semester mark	3

Course type	Course code	Course language	Timetable information
Laboratory	A0	English	THU:08:15-12:00(F11FK)

i) Equilibrium states: One componenet liquid-vapor phase equilibrium. Apparent heat of evaporation; Two component liquid-liquid phase equilibrium. Critical temperature of miscibility; Electrochemical equilibrium and electromotive force of a galvanic cell. Nernstian operation; Calorimetry. Heat of an acid-base reaction. Specific heat of an organic liquid. ii) Reaction kinetics: Rate constant of iodination of acetone; Order of a component in kinetics of decomposition of hydrogen peroxide iii) Measurements in transport phenomena: Electrolyte conductivity. Molar conductivity. Dissociation constant of a weak electrolyte; Rheology. Viscosity of a Newtonian liquid. Flow curve of a thixotropic slurry. Literature:

Subject code	Subject name	Requirement	ECTS credit
BMEVEFAM201	Physical chemistry and structural chemistry	Exam	5

Course type	Course code	Course language	Timetable information
Lecture	A0-ER	English	TUE:08:15-10:00(CH201); WED:14:15-17:00(CH201)

Interactions of atoms and molecules with particules and external fields: Interactions with particles, electric field, magnetic field, elementary magnets, diamagnetism, precession of magnetic moment, paramagnetism, interaction with electromagnetic waves, the electromagnetic spectrum. Structure and properties of atoms: The hydrogen atom, the structure of the hydrogen atom, angular and magnetic moments of the hydrogen atom, angular and magnetic moments of the hydrogen atom, the electronic spectrum of the hydrogen atom. Many-electron atoms: hydrogenic atoms, other many-electron atoms interactions with external magnetic field, with external electric field interpretation of other many-electron atoms, measurement of atomic spectra. Ions. Ionization, interactions of ions Structure and properties of molecules Molecular symmetry: symmetry elements, operations, point groups, representations. The electronic structure of molecules: construction of molecular orbitals, localized orbitals. The covalent bond: characteristics of the covalent bond, he structure of two-atomic molecules, hybridization, delocalized systems, complex compounds of transition elements. Rotation of molecules: diatomic molecules, polyatomic and their rotational spectra. Vibration of molecules: vibrational motion and spectra of diatomic molecules, vibrational motion and spectra of polyatomic molecules. Non-linear spectroscopy: other vibrational spectroscopic methods; large amplitude motions. Electronic transitions in molecules: excitation of electrons, types of electronic transitions, excited state and its decay, excitation spectrum and substituent effect, measurement and application of excitation spectra, ultraviolet photoelectron spectroscopy. Dispersion of light: dispersion and refractive index, electron excitation with polarized light. Mass spectroscopy: principle and instrumentation, applications. Paramagnetic resonance: paramagnetic molecules, electron spin resonance. Nuclear magnetic resonance: the resonance, spin-spin interactions, 13C-NMR spectroscopy, recording NMR data, the Overhauser effect, relaxation processes, measurement of relaxation processes, two-dimensional NMR spectroscopy. Diffraction methods and molecular structure: diffraction methods, scattering on isolated molecules, electron diffraction in gas phase, character of measured and calculated geoemetric parameters. The structure of atomic and molecular ensembles Intermolecular interactions: theoretical descriptions, types of interactions. Structure of molecular ensembles: liquid state models, the structure of liquids, the solid crystalline state, conductors, semiconductors and insulators in solid atate. Diffraction methods: in structure investigation of ordered systems, methods: X-ray diffraction, electron diffraction, neutron diffraction. Spectroscopic methods: X-ray photoelectron spectroscopy, Auger electron spectroscopy, secondary ion emission mass spectroscopy, Mouml;ssbauer spectroscopy, vibrational spectroscopy in condensed phases.

Subject code	Subject name	Requirement	ECTS credit
BMEVEFAM212	Biopolymers	Exam	4

Course type	Course code	Course language	Timetable information
Laboratory	laboratory-ER	English	
Lecture	theory-ER	English	THU:08:15-10:00(HF2)

Biopolymers are polymers arising in living organisms (e.g. microorganisms or higher order plants and animals) or synthesized from bio-based building blocks (e.g. acids, amino acids, carbohydrates, natural triglycerides) in a chemical process. The course introduces the students to the most significant biopolymers, their chemical structure, properties and the most important application areas

Subject code	Subject name	Requirement	ECTS credit
BMEVEFAM503	Nonconventional Materials	Mid-semester mark	3

Course type	Course code	Course language	Timetable information
Lecture	A0	English	THU:12:15-14:00(F1MFK)

In the modern materials science the main goal is designing materials to accomplish multiple properties in a single system. Usually these materials can respond to environmental stimuli by exhibiting particular changes in some of their properties. The aim of this course is to provide theoretical and practical knowledge in the chapters of modern materials science based on the colloids science (“the world of nano”), surface chemistry and physical chemistry of polymers.

Subject code	Subject name	Requirement	ECTS credit
BMEVEFKAKM1	Physical Chemistry and Radiochemistry	Mid-semester mark	3

Course type	Course code	Course language	Timetable information
Laboratory	A1-ER	English	WED:16:15-19:00(F11FK)
Lecture	A0-ER	English	THU:08:15-10:00(CH306)

The course covers the laws of thermodynamics and their application to the properties of gases, liquids, and solids, and to homogeneous and heterogeneous equilibria; chemical kinetics. Nature, production and applications of radioactivity. Topics will include: radioactive decay processes, types of radioactive decay, atomic nuclei, interactions with matter; radiochemical instrumentation; nuclear reactions.

Subject code	Subject name	Requirement	ECTS credit
BMEVEKFA513	Theory of Separation Processes and Reactors	Exam	4

Course type	Course code	Course language	Timetable information
Lecture	eng_th	English	THU:12:15-15:00(F211)
Practice	eng	English	THU:12:15-15:00(F211)

Subject code	Subject name	Requirement	ECTS credit
BMEVEKFMBR1	Environmentally Benign and Catalytic Processes	Exam	4

Course type	Course code	Course language	Timetable information
Lecture	eng_ER	English	FRI:08:15-11:00(CH302)

National and international activities with respect to environmental programs. quot;Cleanquot; technologies. EU directives, tendencies, regulations. Clean air projects, activities, processes. Classification of air pollutants, intervention places, exhaust reduction. Water quality control, physico-chemical treatment of waste waters, WAO, stripping with air or steam. Clean technologies, supercritical solvents and processes. Membrane processes, case studies. Catalytic processes, working mode of catalysts, kinetics, catalyst preparation, testing, modification, catalyst poisons, catalytic reactors, economics of catalytic processes. Catalytic processes in environmental technologies, automotive catalysis, fuel-cells, hydrogen and methanol economy. At the practices the students get individual tasks, get acquainted with the chosen topic, carry out measurements, evaluate them and finally report about their results in written and oral form.

Subject code	Subject name	Requirement	ECTS credit
BMEVESAA101	General Chemistry	Exam	5

Course type	Course code	Course language	Timetable information
Lecture	A20-ER	English	WED:08:15-10:00(CHFGEP); THU:10:15-12:00(CHFGEP)

The subject of chemistry. Material, the structure of the material, mixtures, energy and mass conservation. Atoms, molecules, elements compounds, ions, mol. Chemical formula, stoichiometry, concentration and its measurement. Chemical reactions and their types. Redox reactions, oxidation number acid-base reactions, acid-base theories, pH. Characterisation of the gaseous state, gas laws. The liquid and the solid states. Phase transitions and their characterisation by phase diagramms. Crystallization, sublimation and distillation. Thermochemistry. Chemical equlibria. The Le Chatellier principle. Homogenous and heterogenous mixtures. Specific chemical equlibria, pH equlibria, solubility product constant. Basics of electrochemistry. Electrolysis, Faradayrsquo;s law. Electrode potential, redox electrodes, metal electrodes, gas electrodes. Ionic conductivity. Galvanic cell and redox equilibria. Chemical kinetics, reaction rate, rate constant, activation barrier, Arrheniusrsquo; law. Thermodynamics and kinetics for a reaction. Basics of colloids, definitions. Atoms electrons, atomic structure. Atomic orbitals, the hydrogen atom. Multielectron atoms, the Aufbau principle. The periodic table of the elements. The chemical bond in H2. Covalent, ionic and dative bonds. Diatomic molecules the sigma and the pi-bond. Delocalization. Hybridization and molecular structure. VSEPR theory. Metals. Molecular movements, rotation, vibration.

Subject code	Subject name	Requirement	ECTS credit
BMEVESAA104	General Chemistry Calculations for Chemical Engineers	Mid-semester mark	4

Course type	Course code	Course language	Timetable information
Practice	A9-ER	English	FRI:08:15-11:00(F211)

Expression for the composition of solutions and their applications. Operations with solutions, crystallization, recrystallization. Gases. Properties of gases. Equation of state for ideal gas, and its versions. Boylersquo;s law, Charlesrsquo; laws. Gay-Lussacrsquo; law. Mixtures of gases, compositions. Partial pressure, and volume. Daltonrsquo;s rule and Amagatrsquo;s rule. Vapor pressure. Colligative properties of dilute solutions. Vapor pressure lowering, boiling-point elevation, and freezing-point depression, osmosis. Balancing equations. Oxidation numbers, redox equations. Stoichiometry and its applications. Yield. Avogadrorsquo;s law. Calculation of titration. Basic terms in thermochemistry. Energy, heat and enthalpy. Heat capacity, molar heat capacity. The heat of reactions and Hess's law. General description of chemical equilibria. Various forms of equilibrium constants and their connections. Application of LeChatelier's principle. The shift in the equilibrium composition by the change in the amount of reactants, in the pressure, and in the temperature. Heterogeneous equilibria. Acid-base equilibria, pH of solutions; Electrochemisty;

Subject code	Subject name	Requirement	ECTS credit
BMEVESAA302	Analytical Chemistry I.	Mid-semester mark	5

Course type	Course code	Course language	Timetable information
Lecture	A9-ER	English	TUE:14:15-16:00(CH307); WED:15:15-17:00(CH305)

Fundamentals of chemical analysis: sampling and sample preparation, separation techniques, and error calculations. Evaluation of analytical data. Gravimetric methods of analysis. Titrimetric methods of analysis: precipitation, acid-base, complex formation, and oxidation-reduction titrations. Theory and applications of

instrumental analytical methods: potentiometry, voltammetry, conductometry, thermal analysis, liquid and gas chromatography, flame photometry, atomic absorption spectrometry, ultraviolet, visible and infrared molecular spectroscopy.

Subject code	Subject name	Requirement	ECTS credit
BMEVESAM202	Material Science Analysis Methods	Mid-semester mark	4

Course type	Course code	Course language	Timetable information
Laboratory	AL6-ER	English	TUE:10:15-14:00(CHFAA)
Lecture	AE6-ER	English	THU:13:15-15:00(K144)

The course will give a broad overview on the measurement methods used in materials science involving nanotechnology, inorganic chemistry, polymers, biomaterials, organic materials. During the laboratory practices the students will get both theoretical knowledge and practical experience about a large number of analytical methods and instruments

Subject code	Subject name	Requirement	ECTS credit
BMEVESZA301	Organic Chemistry I.	Exam	5

Course type	Course code	Course language	Timetable information
Lecture	A16-ER	English	MON:10:15-12:00(CH306); TUE:10:15-12:00(CH306)
Practice	A17-ER	English	MON:10:15-12:00(CH306); TUE:10:15-12:00(CH306)

Structures of molecules; Stereochemistry, configuration, conformation; Theory of reactions, theories of acid and bases, HSAB and FMO theories; Theory of redox and radical reactions, chemistry of paraffins. Reactivity of olefines and acetylenes, electrophilic addition, oxidation and polymerization; Reactivity of monocyclic aromatic compounds, electrophilic substitution; The theory of substitution and elimination; The chemistry of halogen compounds, alcohols, phenols and ethers; The chemistry of nitro compounds and amines; Reduction and oxidation of alcohols, oxo compounds and carboxylic acid derivatives; Reactivity of oxo compounds, carboxylic acids and carboxylic acid derivatives; Oxo-enol tautomerism; Chemistry of carboxylic acids; Chemistry of carboxylic acid derivatives;

Subject code	Subject name	Requirement	ECTS credit
BMEVESZM704	Biocatalysis	Mid-semester mark	2

Course type	Course code	Course language	Timetable information
Lecture	10-ER	English	TUE:15:15-17:00(CH304)

The subject gives an overview on biocatalysis and biotransformation with special emphasis on stereoselective methods for chemical engineers and bioengineers for chemical and bioindustries (pharma, fine chemicals, food and cosmetics industries). The interdiscliplinary subject aims to improve probem solving capabilities related to stereochemical as well as biotechnology issues such as protein structure, enzyme immobilization and molecular genetics tools for biocatalysts development. General features of biotransformations and biocatalysis - Enzyme and cell immobilization - Development of novel biocatalysts by traditional and molecular genetics methods - Stereochemical questions related to biotransformations - Selectivity types in biotransformations - Biotransformations with isolated enzymes (hydrolases, oxido-reductases, liases, transferases) - Biotransformations with multienzyme systems - Synthetic whole-cell biotransformations with traditional and recombinant microbes - Industrial biotransformations: examples of biotransformations on industrial scale.

Subject code	Subject name	Requirement	ECTS credit
BMEVEVMA606	Design of Experiments	Mid-semester mark	3

Course type	Course code	Course language	Timetable information
Lecture	Eng1-ER	English	THU:16:15-19:00(CH201)
Practice	Eng2-ER	English	THU:16:15-19:00(CH201)

Random variable, density and distribution function, expected value, variance. Continuous distributions, normal distribution, standard normal distribution, #61539;2, t and F distribution. Central limit theorem. Population and sample. Parameter estimation. Hypothesis testing, parametric tests. Mutual distribution of several random variables, correlation. Principles of regression, linear regression. Checking adequacy, weighted regression, parameter estimation, partition of SSQ, confidence intervals. Design of experiments. 2p full factorial: the design, orthogonality and rotatability, estimation of parameters, significance tests. 2p-r fractional factorials.

Subject code	Subject name	Requirement	ECTS credit
BMEVEVMA709	Computer Process Control	Mid-semester mark	4

Course type	Course code	Course language	Timetable information
Laboratory	eng_lab-ER	English	TUE:10:15-13:00(F211)
Lecture	english-ER	English	TUE:10:15-13:00(F211)

Hardware and software of computer control, on-line data collection, supervisory control, direct digital control, sampled data system, theory of sampled data systems, bdquo;Zrdquo; transformation, relations between Laplace and Z-transformations, stability in Z plane, examples for samled data systems.