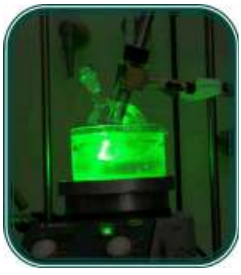
Faculty of Chemical Technology and Biotechnology

The education of chemical engineers and chemists has a long-standing tradition in Hungary dating back to the 18th century. Chemical engineering curricula, separating from that of mechanical and civil engineers, reach back to the 1863/64 academic year. In the 1960s chemical engineering studies were extended to the master level and introduced the range of specialised studies already. A doctoral school having a pioneering PhD program has also been established which was developed to be one of the most successful one in Hungary. Studies in English at the Faculty of Chemical Technology and Biotechnology began in the 1985/86 academic year. Currently bachelor (BSc, 7 semesters), master (MSc, 4 semesters) and doctoral (PhD, 8 semesters) studies are offered. Although the education profile in Hungarian includes chemical, biochemical and environmental engineering at each level, pharmaceutical and polymer and textile engineering at MSc level, the English curricula are only offered in chemical engineering (all levels), in environmental engineering (master level) and as doctoral studies. However, elective courses are available in English in all areas of our education. All programs are organised in the credit system providing a relatively high degree of freedom in subject selection, but prerequisites have to be taken into account when the individual study program is set.

Further information on the Faculty can be found at our website: http://ch.bme.hu/en/

Bachelor in chemical engineering



The BSc degree course in chemical engineering provides the appropriate skills and knowledge in chemistry, chemical engineering and economic sciences. The degree holder should be able to manage chemical technologies, conduct analytical tests, intermediate and final quality control, and can take part in R&D, planning, and public administration. Part of the education is specialisation in a branch.

Applicants of interested in chemical engineering are welcome. Entrance exams include chemistry or physics and mathematics. A B2 level (according to CEFR) of English is required. A one year long pre-engineering study is also possible if needed (see the relevant chapter of this bulletin).

Students in the BSc chemical engineering program receive a thorough core curriculum. These include natural sciences as chemistry, mathematics and physics, and engineering fundamentals as unit operations, process control. We assure, that our students besides a profound theoretical knowledge, can acquire up-to-date laboratory skills, get acquainted with the machines and apparati used in the chemical industry, know

the principles needed for their optimal operation, and develop expertise in a more specific technology within the chemical, food and light industries. Furthermore, our chemical engineering branch, compared to the typical curricula internationally, is highly synthetic and analytical chemistry focused resulting in an excellent understanding of chemical processes and their monitoring. Specialisations start in the fifth semester and are available to students depending on the number of applicants (minimum 5):

- Analytical and Structural Chemistry
- Chemical and Process Engineering
- Industrial Pharmaceutics
- Materials Science, Plastic and Textile Technology

The studies are completed by performing an individual bachelor thesis project and submission of the thesis. Graduation is completed, after all required credits are gained, by a successful defence of the thesis and a final examination before the Final Examination Board of professors and eminent industrialists.

Master in chemical engineering

Chemical engineering MSc students get a high level knowledge in natural sciences, engineering, informatics and economics as well as in humanities. On an international comparison our curriculum is chemistry focused, and it is especially suitable for motivated applicants having carrier plans in research and development or project management.

Applicants of holding chemical engineering bachelor degree (or related) are welcome to widen their knowledge and skills in technological scientific fields of the chemical industry. Entrance exams include chemistry and mathematics. A B2 level (according to CEFR) of English is required.

Graduates will be versed in:

- operations and personnel involved in chemical processes on an industrial scale,
- development of the technology and products of industrial chemical processes,
- design of industrial chemical processes,

- how a chemical product or application is introduced into the national economy, and
- innovation of chemical processes, operations and technologies.

The newly reformed specialisation program offers a wide selection of courses grouped in five modules: analytics, materials science, biotechnology, pharmaceuticals and technology. Those, who completely gain the credits of any of these modules, will receive an extra certificate at their graduation. It is also possible to select the most interesting ones from the listed courses to gain a wide knowledge of the most important fields of the modern chemical industry.

The studies are completed by performing an individual master thesis project and submission of the thesis. Graduation is completed, after all required credits are gained, by a successful defence of the thesis and a final examination before the Final Examination Board of professors and eminent industrialists.

Master in environmental engineering

Protection of the environment is a major global issue and all nations have their task to ensure the availability of pure air, drinking water and rich soil for our and for the next generation. Obviously, industrial production is required to fulfil the needs of our societies. Thus engineers are required in each sectors of industry having deep knowledge both in their sector and in the environmental protection field. One of the biggest and most reputed institutions of this kind in Europe, the Budapest University of Technology and Economics has educated generations of engineers since its foundation in 1782. Its eight faculties of different engineering disciplines, sciences, economics and humanities actively participate in environmental education granting among others postgraduate degrees from 1974 onwards. The University has excellent training facilities: laboratories, pilot plants, computer network and a wide system of international relations.

Environmental engineering graduates are able to

- understand technologies especially be involved in developments aiming emission minimization
- select the best technique for environment protection and has a good understanding on the role of optimization
- evaluate and use analytical data and make decisions based on evidence
- are practiced in using the management tools of environmental protection
- communicate efficiently with professionals of various fields and with the public as well.

Environmental engineers find jobs in all industrial sectors since the environmental protection has profound importance in the modern industry. Environmental engineers graduated at BME are excellent in understanding chemical pollution, chemical analytics and chemical processes.

Applicants of holding any engineering degrees are welcome to widen their knowledge and skills in technological and managements fields of environmental protection. Good knowledge in chemistry, mathematics and engineering are required, since the aim of the curricula to top up an instantly applicable knowledge in all areas of environmental protection. Entrance exams include basic chemistry, physics and mathematics. A B2 level (according to CEFR) of English is required.

The environmental engineering curricula is offered with a completely reformed program from September 2017 to ensure, that we meet the needs and challenges of students planning their career either in developed or in developing countries. For the actual study program please visit our website. Two specialisations are available (min 10 applicants): environmental technology and environmental management. All environmental engineers are trained in both fields, but selecting a specialization gives the possibility to focus on the more preferred area.

Environmental technology especially focuses on applied environmental science and technological aspects of environmental protection, pollution evaluation, data evaluation, reduction of waste formation and primary energy requirement of various processes and pollution removal. The specialization offers a large selectivity among specialized courses. Environmental management aims to develop the theoretical and soft skills required to actively and efficiently coordinate activities for the protection of the environment, to manage financial, technical and human resources for the sake of protecting air and water and reducing or reusing waste.

The studies are completed by performing an individual master's thesis project and submission of the thesis. Graduation is completed, after all required credits are gained, by a successful defence of the thesis and a final examination before the Final Examination Board of professors and eminent industrialists.

Doctoral studies

The George Oláh PhD School is eligible to issue PhD degrees from:

- Chemistry
- Chemical- bio- and environmental engineering

We are proudly having the allowance of Nobel Laurate George Oláh, a former student and faculty member, to use his name. "Nomen est Omen", in accordance with the high expectations our PhD School has strong requirements at an internationally highly competitive level (see also PhD minimum requirements). The PhD program lasts for 2+2 years. After the first two years, the prerequisite for the continuation is a successful completion of a "complex examination". During this evaluation the examining board investigates if the PhD candidate has made an appropriate progress in the PhD work within the time frame of the first two years, and whether the continuation will predictably result in the successful completion of the PhD work within the next two years.

The basic requirement for the enrollment is an MSc (or equivalent) degree from chemistry, chemical engineering or a related topic. For the enrollment the previous results during the BSc and MSc studies, documents about any scientific activities (papers, scientific presentations etc.) should be presented, and an interview (personally, or via skype, or by any other possible means) should be carried out in the presence of the prospective supervisor and two other members of the examining committee. The decision about the enrolment of a PhD candidate will then be made by the Council of the Doctoral School upon the suggestion given by the examining committee.

The list of the approved PhD research projects to be offered are renewed two times a year (next update is on November 21. 2016). The research projects offered can be modified with the agreement of the supervisor. All projects are subject to approval by the Council of the Doctoral School to ensure that they are likely to result in a successful completion with the expectedly devoted work of the applicant.

The most important part of the PhD curriculum is the research work carried out by the guidance of the supervisor. The supervisor is a key person during the PhD process, and a thorough cooperation between the PhD candidate and the supervisor is of utmost importance. The research project must be worked out by the supervisor, since the necessary background (laboratory facilities, specific instruments etc.) determines the success of the entire PhD project. To obtain information on the supervisor it is advised to study the approved PhD research projects offered, the personal home page, as well as the scientific publications in the Web of Science database if available, or alternatively in Google Scholar, which is free of charge.

Additionally to the research work itself, which is the core of the PhD studies, some PhD courses from the basic disciplines of chemistry, as well as from highly specialized topics should be completed. The directed teaching" is an integral part of the curriculum as well, aimed at broadening the knowledge of the PhD student by teaching undergraduates. This teaching activity is maximized in four hours per week during a semester.

The PhD degree can be awarded upon the decision of the Doctoral Council of the University, provided that certain minimum requirements" among others of a (i) completion of the "complex examination" (ii) publication of at least three peer reviewed scientific papers in journals with SCI impact factors with dominating (more than 50%) contribution of the applicant (iii) successful defence of the thesis are fulfilled. In spite of these strict minimum requirements more than 70% of our enrolled PhD students obtain the degree. A detailed description of the PhD requirements is available upon request.

For further information please contact Dr. Zoltán Benkő via e-mail (zbenko@mail.bme.hu) and visit our dedicated website (http://www.ch.bme.hu/en/education/PhD)

Departments

- Department of Inorganic and Analytical Chemistry
- Department of Physical Chemistry and Materials Science
- Department of Organic Chemistry and Technology
- Department of Chemical and Environmental Process Engineering
- Department of Applied Biotechnology and Food Science

Budapest University of Technology and Economics
Faculty of Chemical Technology and Biotechnology
Faculty Office:
Building R, ground floor, room 1.
Mailing Address: Műegyetem rkp. 7-9.
H-1111 Budapest, Hungary
Phone: (+36-1) 463-4618
Fax: (+36-1) 463-2550

Dean of the Faculty: Dr. Ferenc Faigl
Course Director: Dr. Zoltán Hell
Program Coordinator: Mrs Kinga Vass

Curriculum of BSc Subjects
General Subjects

Subject			lectures/practical lectures/laboratory							
Name	Code	Credits	1	2	3	4	5	6	7	Requisities
Compulsory English I.	BMEGT63A301	2	0/4/0p							
Compulsory English II.	BMEGT63A302	2		0/4/0p						
English for Engineers	BMEGT63A051	2			0/2/0p					
Communication Skills - English OR	BMEGT63A061	2				0/2/0p				Elective
Manager Communication - English OR	BMEGT63A071	2				0/2/0p				Elective
Intercultural Comm. - English	BMEGT63A091	2				0/2/0p				Elective
Mathematics A1a - Calculus	BMETE90AX00	6	4/2/0e							
General Chemistry	BMEVESAA101	5	4/0/0e							
General Chemistry Calculations	BMEVESAA104	4	0/3/0p							
General Chemistry Laboratory Practice	BMEVESAA209	5		0/0/6p						BMEVESAA101, BMEVESAA104, BMEVESZA101
Computing	BMEVESAA103	2	0/2/0p							
Chemical Eng. Fundamentals	BMEGEVGAV03	2			2/0/0e					
Chemical Engineering Practice	BMEGEVGAV04	3			0/1/2p					
Macro- and Microeconomics	BMEGT30A001	4	4/0/0e							
Mathematics A2c	BMETE90AX17	6		4/2/0e						BMETE90AX00
Mathematics A3 for Chemical Engineers and Bioengineers	BMETE90AX18	4			2/2/0e					
Physics 1 - Mechanics	BMETE14AX15	4	2/2/0e							
Inorganic Chemistry	BMEVESAA208	3		3/0/0p						BMEVESAA101, BMEVESAA104
Inorganic Chemistry Laboratory Practice	BMEVESAA301	3			0/0/4p					BMEVESAA101, BMEVESAA208
Organic Chemistry I.	BMEVESZA301	5			3/2/0e					BMEVESAA101
Chemical Technology	BMEVEKFA203	3		2/0/0p						BMEVESAA101
Physics 1 Electrodynamics	BMETE14AX04	2		2/0/0e						BMETE14AX15
Physics Laboratory	BMETE14AX05	2		0/0/3p						BMETE14AX15
Organic Chemistry II.	BMEVESZA401	4				3/0/0e				BMEVESZA301
Analytical Chemistry	BMEVESAA302	5			4/0/0p					BMEVESAA101, BMEVESAA104
Physical Chemistry I	BMEVEFKA304	5		3/1/0e						BMEVESAA101, BMETE90AX17
Polymers	BMEVEFAA306	5			2/0/2p					BMEVESAA101
Organic Synthesis Laboratory Practice	BMEVESZA402	4				0/0/5p				BMEVESAA104, BMEVESAA209, BMEVESZA301
Analytical Chemistry Laboratory Practice	BMEVESAA403	4				1/0/4p				BMEVESAA209, BMEVESAA302
Physical Chemistry II	BMEVEFAA405	4			2/1/0e					BMEVEFKA304
Medicines	BMEVESZA403	3				2/0/0e				
Colloid chemical approach to nanotechnology	BMEVEFAA409	3				3/0/0p				BMEVEFKA304
Environmental Chemistry and Technology	BMEVEKFA403	4						3/0/0e		BMEVESAA208, BMEVESZA401, BMEVEKFA203
Organic Chemical Technology	BMEVESTA411	3				2/0/0e				BMEVESZA301
Organic Chemical Technology Practice	BMEVESZA412	3				0/0/4p				BMEVESZA301,
Chemical Unit Operations I	BMEVEKFA410	6				3/2/0p				BMEGEVGAV03, BMETE90AX17
Business Law	BMEGT55A001	2					2/0/0p			
Design of Experiments	BMEVEVMA606	3					2/1/0p			BMETE90AX18
Hydrocarbon Processing	BMEVEKFA506	3					2/0/1e			BMEVEKFA203, BMEVEFKA304, BMEVESZA301
Biochemistry	BMEVEBEA301	4					3/0/0e			BMEVESZA401
Physical Chemistry Lab. Prac.	BMEVEFAA506	3					0/0/4p			BMEVEFAA405, BMETE14AX05
Chemical Process Control	BMEVEVMA504	5						2/1/1p		BMEVEKFA410
Chemical Unit Operations II	BMEVEKFA512	6					2/1/4e			BMEVEKFA410
Managem. and Business Econ.	BMEGT20A001	4						4/0/0p		
Safety Technology in the Chemical Industry	BMEVESZA101	2	2/0/0p							
Quality Management	BMEVEKFA615	4							3/0/0p	
Chemical Unit Op. Practice	BMEVEKFA613	3						0/0/4p		BMEVEKFA512
Electives (humanities)	2 subjects	4								
Specialization		26								
Thesis	BMEVE..A999	15							0/0/14p	
Summer Practice	BMEVE..A888	0								6 weeks/s
Electives		10								

Curriculum of BSc Subjects of Specialization

Subject			working hours / week			
Name	Code	Credits	5	6	7	Requisities
Analytical and Structural Chemistry Specialization						
Analytical and Structure Determination Laboratory	BMEVESAA604	5		1/0/4p		BMEVESAA512, BMEVESAA403
Elemental Analysis	BMEVESAA701	3			2/0/0p	BMEVESAA403
Chemical and Biosensors	BMEVEAAA708	3	2/0/0e			BMEVESAA403
Chromatography	BMEVEAAA611	3	2/0/0e			BMEVESAA403
Elucidation of Organic Structures	BMEVESAA512	3	3/0/0p			BMEVESZA401
Theory of Testing Methods in Material Sciences	BMEVEFAA708	4			3/0/0e	BMEVESZA301, BMETE14AX15, BMETE90AX17
Organic Chemistry III	BMEVESKA504	2		2/0/0e		BMEVESZA401
Project Work	BMEVESAA777	3			0/1/0p	BMEVESAA403
Chemical and Process Engineering Specialization						
Hydrocarbon Technology and Catalysis	BMEVEKFA503	5		2/0/3p		BMEVEKFA506
Process Engineering	BMEVEVMA605	5		3/0/2e		BMEVEKFA512
Environmental Benign Chemical Processes	BMEVEVMA607	4		3/0/0e		
Computer Process Control	BMEVEKFA709	3			2/0/1e	BMEVEVMA504
Chemical Production Control	BMEVEKTA707	3			2/0/1p	BMEVEKFA203, BMEVEKFA512
Radiochemistry and Nuclear Energetics	BMEVEKFA502	3	2/0/1p			BMEVESAA101
Project work	BMEVEKFA777	3			0/1/0p	
Industral Pharmaceutics Specialization						
Elucidation of Organic Structures	BMEVESAA512	3	3/0/0p			BMEVESZA401
Organic Chemistry III	BMEVESKA504	2		2/0/0e		BMEVESZA401
Organic Chemistry Laboratory Practice II	BMEVESKA605	5	0/0/6p			BMEVESZA401, BMEVESZA402
Pharmaceutical Technology I.	BMEVESTA704	2			2/0/0p	BMEVESTA606
Unit processes in Industrial Drug Synthesis Laboratory Practice	BMEVESTA705	4			0/0/5p	BMEVESTA606
Unit processes in Industrial Drug Synthesis	BMEVESTA606	2		2/0/0e		
Technology of Pharmaceutical Materials	BMEVESTA607	3		2/0/1e		BMEVESZA301
Unit Processes of Organic Chemistry	BMEVESTA508	2	2/0/0e			BMEVESTA411
Project work	BMEVESZA777	3			0/1/0p	
Materials Science						
Testing Methods in Material Sciences	BMEVEMGA502	3			0/0/4p	
Physical Chemistry of Surfaces	BMEVEFKA603	3		2/0/0e		BMEVEFAA409
Material Science Laboratory Practice	BMEVEMGA603	3		0/0/4p		BMEVEFAA708
Polymer Physics	BMEVEMGA511	3	2/0/0e			BMEVEFAA306
Project Work	BMEVFAA777	3			0/1/0p	
Nonconventional Materials	BMEVEFAA707	3			2/0/1p	BMEVEFAA405
Metals and Metal Matrix Composites	BMEVEFAA602	2		2/0/0e		
Modern Engineering Ceramics	BMEVEFAA601	2		2/0/0e		
Theory of Testing Methods in Material Sciences	BMEVEFAA708	4	3/0/0p			
Polymer Technology Specialization						
Theory of Testing Methods in Material Sciences	BMEVEFAA708	4	3/0/0p			
Machines and Moulds for Polymer Processing	BMEVEFAA705	4			2/0/1p	BMEVEMGA608
Polymer Processing	BMEVEMGA608	7		4/0/5e		BMEVEMGA511
Polymer Physics Laboratory Practice	BMVEMGA509	3	0/0/4p			BMEVEFAA306
Polymer Additives	BMEVEMGA610	2		2/0/0e		BMEVEFAA306
Polymer Physics	BMEVEMGA511	3	2/0/0e			BMEVEFAA306
Project work	BMEVEFAA777	3			0/1/0p	
Textile Technology Specialization						
Theory of Testing Methods in Material Sciences	BMEVEFAA708	4	3/0/0p			BMEVESAA208
Fibre Forming Polymers	BMEVEMGA512	2	2/0/0p			BMEVESZA401
Chemistry of Dyes and Surfactants	BMEVESTA510	2	2/0/0p			BMEVESZA401
Colorimetry, Colormeasurement	BMEVEMGA515	2	2/0/0p			
Chemical Technology of Textiles I.	BMEVEMGA617	7		3/0/4e		BMEVEMGA512
Chemical Technology of Textiles II.	BMEVEFAA718	4			2/0/2p	BMEVEMGA617
Project work	BMEVEFAA777	3			0/1/0p	

Curriculum of MSc Subjects

Subject			hours/week				
Name	Code	Credits	1	2	3	4	Remarks
General subjects							
Material Science Analysis Methods	BMEVESAM202	4	2/0/2p				fall semester
Physical Chemistry and Structural Chemistry	BMEVEFAM201	5	5/0/0e				fall semester
Environmentally Benign and Catalytic Processes	BMEVEKFM210	5	3/0/1e				fall semester
Organic Chemical Technology II	BMEVESZM201	5	2/0/2p				fall semester
Computational Chemistry	BMEVESAM301	3				2/0/1e	spring semester
Thesis Project I	BMEVEyyMxxx	15			0/0/11p		
Summer Practice	BMEVExxM888	0		4 weeks/s			
Thesis Project II	BMEVEyyMxxx	15				0/0/11p	
Materials science: Traditional Structural Materials and Polymers	BMEVEFAM110	4		2/0/1e			spring semester
Chemical Process Design and Control	BMEVEKFM101	4		2/0/2p			spring semester
Complex and Inorganic Chemistry	BMEVESAM101	2		2/0/0p			spring semester
Mathematics M1c - Differential Equations	BMETE90MX44	3		2/1/0e			spring semester
Intellectual Property Management	BMEVEFAM103	2		2/0/0e			spring semester
Organic Chemistry	BMEVESZM101	4		3/0/0e			spring semester
Social and Visual Communication	BMEGT43MS07	2		2/0/0p			spring semester
Design of Experiments 2	BMEVEKFM209	3	2/0/0p				fall semester
Modern Physics for Chemical Engineers	BMETE14MX00	3			3/0/0e		fall semester
Biology, Biotechnology	BMEVEMBM301	3				2/0/0p	spring semester
Economic Analyses of Technology	BMEGT30MS07	2				2/0/0e	spring semester
Quality Control	BMEVESAM206	2			2/0/0p		fall semester
Technology Management	BMEGT20M005	2			2/0/0p		fall semester
Modern Chemical Technology							
Modern Separation Technologies	BMEVEKFM104	3				2/0/1p	technology modul, spring semester
Organic Chemical Technology	BMEVESZM503	3				2/0/0e	pharmaceuticals modul, spring semester
Process Engineering	BMEVEKFM211	4			2/0/1p		technology modul, fall semester
Conventional and Modern Forms of Energy Production	BMEVEKFM302	4				2/0/1e	technology modul, spring semester
Petrochemistry	BMEVEKFM402	6			2/0/3e		technology modul, fall semester
Unit Processes of Organic Chemistry	BMEVESZM207	3			0/2/0p		pharmaceuticals modul, fall semester
Bioinformatics 2 - proteomics	BMEVESZM501	4			2/0/1p		biotechnology modul, fall semester
Hydrocarbon Technology	BMEVEKFM503	3			2/0/0e		technology modul, fall semester
Radiochemistry and Nuclear Energetics	BMEVEKFM502	3			2/0/1p		technology modul, fall semester
Environmentally Benign Chemical Processes	BMEVEKFM501	4				3/0/0e	technology modul, spring semester
Inorganic Chemistry Laboratory Practice	BMEVESAM502	3			0/0/4p		analytics modul, fall semester
Applied electrochemistry	BMEVESAM505	3			2/0/0e		analytics modul, spring semester
Plastics	BMEVEFAM502	5			2/0/2p		materials sciences modul, fall semester
Analytical and Structure Determintaion Laboratory	BMEVESAM504	5				1/0/4p	analytics modul, spring semester
Chemistry and Technology of Biomaterials	BMEVESZM708	2			2/0/0p		pharmaceuticals modul, fall semester
Medicines	BMEVESZM502	3				2/0/0e	pharmaceuticals modul, spring semester
Biocatalysis	BMEVESZM704	2			2/0/0p		biotechnology modul, fall semester
Nonconventional Materials	BMEVEFAM503	3			2/0/0p		materials sciences modul, fall semester
Biopolymers	BMEVEFAM212	4			2/0/1e		materials science modul, fall semester
Bioinorganic Chemistry	BMEVESAM501	2			2/0/0p		analytics modul, fall semester
Physical Chemistry of Surfaces	BMEVEFAM501	3				2/0/0e	materials science modul, spring semester
Chromatography	BMEVESAM503	3			2/0/0e		analytics modul, fall semester
Environmental Toxicology	BMEVEMBM501	3			1/0/1p		biotechnology modul, fall semester
Bioregulation	BMEVEMBM111	3				2/0/0e	biotechnology modul, fall semester
Methods in Molecular Biology	BMEVEMBM210	3			2/0/0e		biotechnology modul, fall semester

Description of BSc Courses

Analytical Chemistry

BMEVESAA302

Dr Róbert E Gyurcsányi

To provide thorough understanding of the fundamental principles, main methods and applications of chemical analysis (volumetric, gravimetric and instrumental analysis), as well as their tools of trade. The subject aims to provide a basis for later subjects including the Analytical Chemistry Laboratory and other advanced analytical chemistry subjects within Analytical and Structural Chemistry Specialization (5 credits)

Analytical Chemistry Laboratory Practice

BMEVESAA403

Dr Róbert E Gyurcsányi, Dr Gergely Lautner

Based on the theoretical background obtained in the analytical chemistry course the primary objective of the Analytical Chemistry Laboratory Practice is to gain hands-on experience in the various analytical techniques, i.e., volumetric analysis and instrumental methods of analysis. During laboratory practices the students will learn the workflow of quantitative and qualitative analysis gaining insight in the main parts and practical operation of analytical instruments. (4 credits)

Biochemistry

BMEVEBEA301

Dr András Szarka

The subject (biochemistry) is not intended to provide the students with a comprehensive biochemistry knowledge. Instead, it offers a short overview of the biochemical pathways and their connections. Its first part covers basic knowledge from the field of cell biology. The second part focuses on the fundamental principles of enzymology and bioenergetics, which additionally serves as the basis for the third part that concentrates on metabolic processes including the energy production pathways of oxidative phosphorylation and photosynthesis. Finally, the fourth part discusses the basics of molecular biology. (4 credits)

Business Law

BMEGT55A001

The problems of the area will be treated in two major parts. Part One introduces students to the general topics, for example the concept of law, the functions of the law in the socioeconomic life. Some basic legal problems, like the conception, characteristics and functions of the modern state and, in a comparative view, the characteristics of the Anglo-Saxon and continental systems of business law and the development of the Hungarian business law will be also discussed. The emphasis of Part Two is on the questions of company law and competition law presented in a European context. The lectures of this part outline not only the regulations of the Hungarian Company Act and Company Registry Act but they cover EU directives and regulations on companies and competition as well. (2 credits)

Chemical Eng. Fundamentals

BMEGEVGAV03

Statics of rigid and elastic bodies. Materials of mechanical structures. Machine elements: fasteners, seals, vessels, pipes and pipe accessories, bearings, couplings, chain, belt, V-belt drive. Fluid mechanics. System approach. Basic law of fluid flow in pipes. Boundary layers. Compressible flow. Non-Newtonian fluids. Operation, performance and selection of pumps, compressors and vacuum pumps. Handling and transportation of solids in bulk. Characteristics of solids. Fluidization. Storage in silos. Pneumatic conveying. Belt and screw conveyors and bucket elevators. (2 credits) (2 credits)

Chemical Engineering Practice

BMEGEVGAV04

All drawings are made only on the practice hours and are made with free hand used the half ready worksheets. Fundamental rules of technical drawing. Arrangement of views by the European projection system. Sections. Threaded parts. Drawing of welded joints. Fits and tolerances. Reading and detailing training of assembly drawings by free hand sketches. Laboratory exercises: measurement of revolution per minute, measurement of pressure, of flow rate and velocity. Fan measurement. Friction losses in pipes and pipe fittings. Sieve analysis. (3 credits)

Chemical Process Control

BMEVEVMA504

Dr Péter Mizsey, Dr Katalin Koczka, Tibor Nagy

The subject is aiming to teach the students the elementary theoretical and practical knowledge of the control, so that, the engineers of the future will be able to work in a team that designs plants, technologies, devices. And, these items are to be controlled, such a work needs also control knowledge for the chemical and biochemical engineers. (5 credits)

Chemical Technology

BMEVEKFA203

Dr György Pátzay, Dávid Havasi

The aim of the subject is providing information in the fields of chemical technology, chemical and environmental technologies, including knowledge in corrosion protection, energy produc-tion and fuels.

Lectures in the field of chemical technology, basic principles and characteristics, economical environmental and energy efficiency aspects of chemical technologies. Balances, yield, schemes. Inorganic chemical technologies, ammonia, nitric acid, urea, sulfuric acid, fertilizer, iron and steel, aluminium, chlorine and sodium hydroxide productions. Energy production and corrosion processes, crude oil, natural gas and coal processing, ceramic and water treatment industries. (3 credits)

Chemical Unit Operations I

BMEVEKFA410

Dr Endre Rév

Chemical unit operations are basic building units of chemical processes. This first course pro-vides an introduction to hydrodynamic and thermal processes only. This includes material and heat balance, momentum balance, fluid mechanics, concepts of fluid behaviour, Bernoulli equations, transportation of fluids, hydrodynamic models, flow in pipes and channels, steady flow, rheology, viscosity, boundary-layer formation, friction factor, pressure flow through equipment, pressure drop across packed towers. Hydrodynamic unit operations: flow in pipes, mixing, sedimentation (settling), filtration, fluidization. Thermal operations: heat

conduction, heat convection, radiation. Rate of heat transfer, heat transfer coefficient (film theory), Nusselt, Reynolds, Prandtl analogy. Dimensional analysis. Heat transfer of condensation. Double pipe and shell and tube heat exchangers. Evaporation, boiling point rise. Standard and multiple-effect evaporators, vapour compression. (6 credits)

Chemical Unit Operations II

BMEVEKFA512

Dr Edit Székely

This is an introductory course on separation processes and on basic calculations of chemical reactors. Topics cover the basic methods of mass transfer calculations and principles of differ-ent mass transfer processes. Mass, component and heat balance equations are used throughout the course. Distillation, extraction and absorption are discussed in details including equipment and short-cut calculations. Simple estimations for chemical reactors are included. (6 credits)

Chemical Unit Operations Laboratory Practice

BMEVEKFA613

Dr Edit Székely

The aim of the course is to introduce engineer students into the chemical unit operation by a detailed laboratory practice. During the course the students meet selected measurements that represent the most important separation processes, reaction kinetic measurements, and model-ling of some chemical units. (3 credits)

Colloid chemical approach to nanotechnology

BMEVEFAA409

Dr Zoltán Hórvölgyi, Dr Emőke Albert

The main objective of the course is to provide a strong colloid chemical background for the preparation, characterization and application of nanomaterials. (3 credits)

Computing

BMEVESAA103

Dr Gábor Csonka

Basic IT support for engineering computations and presentation of the results (Excel, Word, ChemSketch). Programming in Visual Basic for Excel. (2 credits)

Design of Experiments

BMEVEVMA606

Péter Kunovszki

To teach the basic principles and methods of mathematical statistical treatment of measure-ment data.

To teach the design and analysis of the most basic full factorial experimental designs. (3 credits)

Environmental Chemistry and Technology

BMEVEKFA403

Dr Andrea Nagy-Szabó, Dr Gábor Bajnóczy

Understanding the formation, possible reactions of environmentally polluting materials. Students becomes familiar with the chemistry of pollutants in the air, water and soil.
They get to know main chemical and physico-chemical processes in the atmosphere, hydro-sphere, lithosphere and biosphere will be discussed. Chemical basis and the effects of the en-vironmentally harmful materials on the living and non-living objects will be presented as well. The students will be able to identify contaminants emitted by technological processes. They learn about modern technological processes reducing the harmful emissions decreasing the environmental degradation. (4 credits)

General Chemistry

BMEVESAA101

Dr Gábor Csonka, Dr László Nyulászi

To get a basic overview of the principles of Chemistry, providing introductory information, including definitions etc. which can be used in later specific subjects. The course consists of three parts. In the first one the macroscopic properties of the matter are discussed, including phase transitions. In the second part basic chemical principles as acid-base and redox processes, chemical equilibria, electrochemistry and chemical kinetics will be covered briefly. In the third part the atomic and molecular structure, the chemical bonding and the rules in the periodic table are explained. (5 credits)

General Chemistry Calculations for Chemical Engineers

BMEVESAA104

Dr Gábor Csonka, Dr Zoltán Benkő

The aim of the subject is to increase the knowledge of the freshman students on chemical calculations to the level which provides competent basis for further chemical and technological disciplines (inorganic chemistry, organic chemistry, physical chemistry, unit operation, chemical technology etc.). The practice is held in small groups, depending on the former skills of the students. (4 credits)

General Chemistry Laboratory Practice

BMEVESAA209

Dr Ilona Kovács

In this subject the basic chemistry procedures are practiced (e.g. distillation, recrystallization, sublimation). Passing these exercises the students acquire knowledge about the basic laboratory equipment as well. Simple measurements are also performed (e.g. measurements of mass and volume, measuring the melting and boiling point, density measurement methods, pH measurement). Simple preparative tasks (e.g. precipitation, dissolution of metals, producing gas in laboratory, calefaction, preparation of complexes, electrochemistry) are also completed. (5 credits)

Hydrocarbon processing

BMEVEKFA506

Dr Ákos Fürcht

The aim of the subject is to discuss the importance of crude oil, as a primary energy source. It presents crude oil processing technologies and discuss the common use of the products and describes the challenges of the oil refining business. (3 credits)

Industrial Safety

BMEVESZA101

Dr István Csontos

The aim of this course is to introduce the students to the concepts related to fire and explosion hazards and the treatment of toxic material, which is essential for engineers. Another goal is to provide the essentials of safe work and management skills through many practical examples. The subject also presents the standard safety concepts and practice used in the EU and in the U.S. (2 credits)

Inorganic Chemistry

BMEVESAA208

Dr László Nyulászi
Get a basic overview of the field of Inorganic chemistry. The most important trends and rules determining the physical and chemical properties of the elements and simple chemical compounds, such as the periodic system, redox properties, complexing abilities, acid-base properties are discussed. Physical and chemical properties of the elements and basic inorganic compounds (hydrides, halides, oxides, common inorganic acids and bases) and the chemistry of industrially important inorganic systems are explained. (3 credits)

Inorganic Chemistry Laboratory Practice

BMEVESAA301

Dr Ödön Wagner
The aim of this laboratory practice is to increase the knowledge of the students on the topic of inorganic chemistry. The properties of inorganic compounds and the methods of qualitative analysis are explained. (3 credits)

Macro- and Microeconomics

BMEGT30A001

Introduction to macroeconomics. Output and aggregata demand. Fiscal policy and foregn trade. Money and banking. Interest rates and monetray transmission. Monetray and fiscal policy. Aggregate supply, prices and adjustment to shocks. Inflation, expectations, and credibility. Unemployment. Exchange rates and the balance of payments. Economic growth. Economics and the economy. Tools of economic analysis. Demand, supply and the market. Elasticities of demand and supply. Consumer choice and demand decisions. Introducing supply decisions. Costs and supply. Perfect competition and pure monopoly. Market structure and imperfect competition. The labor market. Factor markets and income distribution. (4 credits)

Management and Business Economics

BMEGT20A001

This course introduces the essentials of management as they apply within the contemporary work environment and gives a conceptual understanding of the role of management in the decision making process. It particular attention is paid to management theories, corporate finance, leadership, teamwork, quality management, management of technology, economics calculation and operations management. For problem formulation both the managerial interpretation and the mathematical techniques are applied. (4 credits) (4 credits)

Mathematics A1a - Calculus

BMETE90AX00

Dr. László Ketskeméty, György Richlik
Algebra of vectors in plane and in space. Arithmetic of complex numbers. Infinite sequences. Limit of a function, some important limits. Continuity. Differentiation: rules, derivatives of elementary functions. Mean value theorems, l'Hospital's rule, Taylor theorem. Curve sketchig for a function, local and absolute extrema. Integration: properties of the Riemann integral, Newton-Leibniz theorem, antiderivatives, integration by parts, integration by substitution. Integration in special classes of functions. Improper integrals. Applications of the integral. (6 credits) (6 credits)

Mathematics A2c

BMETE90AX17

Dr László Ketskeméty, György Richlik
Solving systems of linear equations: elementary row operations, Gauss- Jordan- and Gaussian elimination. Homogeneous systems of linear equations. Arithmetic and rank of matrices. Determinant: geometric interpretation, expansion of determinants. Cramer's rule, interpolation, Vandermonde determinant. Linear space, subspace, generating system, basis, orthogonal and orthonormal basis. Linear maps, linear transformations and their matrices. Kernel, image, dimension theorem. Linear transformations and systems of linear equations. Eigenvalues, eigenvectors, similarity, diagonalizability. Infinite series: convergence, divergence, absolute convergence. Sequences and series of functions, convergence criteria, power series, Taylor series. Fourier series: expansion, odd and even functions. Functions in several variables: continuity, differential and integral calculus, partial derivatives, Young's theorem. Local and global maxima/minima. Vector-vector functions, their derivatives, Jacobi matrix. Integrals: area and volume integral. (6 credits) (6 credits)

Mathematics A3 for Chemical Engineers and Bioengineers

BMETE90AX18

Dr Márta Lázi
Outcomes, events, and probability, conditional probability and independence, discret and continuous random variables, distribution function, density function, expected values and variance, binomial, geometric, poisson, uniform, exponential, normal distribution, joint distributions, and independence, covariance and correlation, the law of large numbers, central limit theorem, exploraory data analysis, graphical and numerical summaries, estimators, unbiased estimators, the linear regression model, confidence intervals, testing hypotheses (4 credits)

Medicines

BMEVESZA403

Dr Ervin Kovács, Dr Ferenc Faigl
The subject gives a brief introduction to the medicinal chemistry and pharmacology. The fun-damental pharmacological definitions and concepts as well as the historical background of drug discovery and design are presented. Selected examples of drug activity at some common target receptors demonstrate the importance of the specific receptor-drug interactions and the importance of chemical modifications of the lead molecules to produce highly selective medi-cines. Concepts related to pharmacokinetics are introduced, such as absorption, distribution, metabolism and excretion. (3 credits)

Organic Chemical Technology

BMEVESTA411

Dr László Hegedűs, Dr György Keglevich
The subject discusses the main fields of organic chemical industry through many suitable examples. (3 credits)

Organic Chemical Technology Practice

BMEVESZA412

Dr István Csontos
The development of practical engineering approach through the presentation of the elements and characteristics of the chemical technologies. (3 credits)

Organic Chemistry I.

BMEVESZA301

Dr Ildikó Móczár, Dr József Kupai, Dr Tünde Tóth
Providing up-to-date basics for chemical engineering students in the field of natural sciences. During this course the students should learn the basics of organic chemistry, they should develop an organic chemistry approach and gain proper theoretical and practical foundation for their further studies on material sciences, organic chemistry, chemical technology and biochemistry (5 credits)

Organic Chemistry II.

BMEVESZA401

Dr József Kupai, Dr Idikó Móczár, Dr Tünde Tóth
Providing up-to-date basics for chemical engineering students in the field of natural sciences. During this course the students should learn the basics of organic chemistry, they should develop an organic chemistry approach and gain proper theoretical and practical foundation for their further studies on material sciences, organic chemistry, chemical technology and biochemistry. This subject is the completion of the subject Organic Chemistry I. (4 credits)

Organic Synthesis Laboratory Practice

BMEVESZA402

Dr László Poppe, Dr Gábor Hornyánszki, Dr Tünde Tóth
Basic laboratory practice for chemical engineering students to acquire the skill of performing laboratory tasks and new laboratory methodologies of organic chemistry. During this course the students learn the basics of synthetic laboratory work, safe work methods, simple and rapid identification of the synthesized materials, and the use of the literature of organic chemistry, deepen their knowledge in this field, and gain substantial knowledge on the properties of organic compounds. (4 credits)

Physical Chemistry I

BMEVEFKA304

Dr Mihály Kállay, Dr Krisztina László
The course is part of the compulsory curriculum. A theoretical and practical introduction to physico-chemical phenomena related to equilibrium". Topics covered include: Definition of thermodynamic state functions and demonstration of their use in chemical engineering and biochemical engineering practices; Interpretation of multicomponent phase equilibria and chemical equilibria with the help of chemical potential. The rate of processes is covered in Physical Chemistry II. (5 credits)

Physical Chemistry II

BMEVEFAA405

Dr András Szilágyi, Dr Mihály Kállay
The course provides theoretical and practical knowledge on the chapters of physical chemistry related to change". The rates of processes, as well as equilibrium electrochemistry are discussed. The three main chapters of Physical Chemistry II are Reaction Kinetics, Transport Processes and Electrochemistry (4 credits)

Physical Chemistry Laboratory Practice

BMEVEFAA506

Dr Benjámin Gyarmati, Dr János Bódiss
Further deepening of the knowledge gained in Physical Chemistry (I-II) and Colloid Chemical Approach to Nanotechnology by the introduction of basic experimental methods in thermodynamics and reaction kinetics. Laboratory work and measurements of physico-chemical properties of materials will be accompanied by determination of experimental errors using statistical methods, and introducing some basic skills in experimental design. (3 credits)

Physics 1 - Mechanics

BMETE14AX15

Introduction. Models, theories and laws. Units, standards, SI system. Reference frames. Coordinate systems. Vectors and scalars. Kinematics: speed, displacement, average velocity, instantaneous velocity, acceleration. Uniform motion, uniformly accelerated motion, falling bodies projectile motion. Circular motions. Dynamics: interactions, force, Newton's laws of motion, mass. Applications of Newton's laws. Gravitation and Newton's synthesis. Weight and weightlessness. Kepler's laws. Work and energy. Work-energy theorem. Translational energy. Conservative forces. Potential energy. Mechanical energy and its conservation. Non-conservative forces. Law of energy conservation. Linear momentum and its relation to force. Conservation of the linear momentum. Many bodies problem. Center of mass. Conservation of momentum and the energy in collisions. Oscillations. Simple harmonic motion. Damped harmonic motion. Forced vibrations. Resonance. Simple pendulum. Rotational motion. Angular quantities. Moment of the force: torque. Angular momentum. Conservation of angular momentum. Rotational dynamics. Rigid bodies. Angular momentum and torque for a rigid body. Moment of inertia. Elasticity and elastic moduli. Stress and strain. Fluids at rest. Pressure. Pascal's principle. Fluids in gravitational field. Archimedes' principle. Characteristics of flow. Flow rate and equations of continuity. Laminar flow. Bernoulli's equation. Viscosity. Turbulent flow. Drag force. Dynamical lift. (4 credits)

Physics 1 Electrodynamics

BMETE14AX04

Maxwell equations: a qualitative introduction. Main chapters of Electrodynamics according to the Maxwell equations. Electrostatics. Coulomb's law. E the electric field strength and its measurement. D the electric induction and its measurement. Electric charge density. Local form of Gauss' law. Electric voltage and potential. Capacitors. Electric field and potential in conductors. Electric wind. The electric dipole and its potential field. Electric field and induction in dielectric materials. Polarization mechanisms. Piezo- and ferro-electricity. Magnetostatics. Para-, ferro- and diamagnetism. Stationary fields and direct current. Electric current and current density. Global and local forms of Ohm's law. Mechanisms of the electric conduction. Work and power of the electric current. Kirchhoff's current and voltage law. Batteries. Electromotive force. The magnetic field H of the electric current. The Oersted experiment and Ampére's law. Magnetic field of a solenoid and measurement of H by compensation. The force acting on a current and the torque acting on a current loop in a magnetic field. Measurement of the magnetic induction B. Moving point charge in a magnetic field. Forces between currents. Quasi-stationary fields and alternating currents. Faraday's law of electromagnetic induction. Eddy currents and Lenz' law. Self induction and mutual induction. Complex amplitude of the alternating current and voltage. AC circuits. Average power of AC. Rapidly changing electromagnetic fields and waves. Displacement current. Hertz' experiment. Summary of electrodynamics. (2 credits)

Physics Laboratory

BMETE14AX05

Introduction: Evaluation of measurement data; DC and AC circuits. Measurements, prctices: nonlinear curve fitting; mechanics: elastic force, periodic motions; DC circuit: control of electric current and voltage; geometrical optics: lenses, prism, refractory index; physical optics: diffraction, wave length, Brewster angle, polarization; AC circuit: resonance in series RLC circuit; semiconductor diodes; temperature measurement; logical circuits; dynamical systems (2 credits)

Polymers

BMEVEFAA306

Dr Béla Pukánszky, Dr János Móczó
To supply basic information about plastics for chemical engineering students. Encountering plastics is unavoidable these days both in everyday life and in engineering practice. The course provides the necessary basic knowledge for engineering practice, teaches ways to recognize the main sources of actual problems and offers methods to remedy them. The individual classes discuss the production, processing, behaviour and properties of plastics, as well as related environmental issues. (5 credits)

Quality Management

BMEVEKFA615

Péter Kunovszki, Bálint Bedzsula
To learn the philosophy and fundamental techniques of quality management. To learn the most important statistical tools of quality engineering. (4 credits)

Description of BSc Courses - Specializations

Analytical and Structural Chemistry

Analytical and Structure Determination Laboratory

BMEVESAA604

Dr Imre Miklós Szilágyi
During the laboratory practices the students will become familiar with the state-of-the-art analytical and structural chemistry instruments at the disposal of the Department of Inorganic and Analytical Chemistry (and at the Faculty of Chemical Technology and Biotechnology). They will learn the basics of advanced and coupled instrumental measurement methods of quantitative analysis, as well as of the study and elucidation of the molecular structure. (5 credits)

Chemical and Biosensors

BMEVEAAA708

Dr Róbert E Gyurcsányi
The course covers the principles, materials, methods and selected applications of chemical and biosensing devices and systems. It presents the main modalities to integrate molecular recognition with various forms of signal transduction, such as electrochemical, optical, mass, and acoustic. The performance characteristics of the sensors are linked to their design, type of receptors, materials and signal transduction, identifying strategies for enhanced selectivity and sensitivity. The topics emphasize state of the art medical diagnostic, environmental and food safety applications of chemical and biosensors. Upon successful completion of the course, students are expected:
a) to understand chemical and biosensing and the motivation behind sensor development
b) to understand the performance characteristics and applicability of chemical and biosensors
c) to become familiar with synthetic and biological origin receptors and the basics of molecular recognition mechanisms.
d) to understand transduction mechanisms and the modalities of coupling with selective molecular recognition
e) to be able to extend the principles of chemical and biosensing towards developing biosensing devices. (3 credits)

Chromatography

BMEVEAAA611

Dr Blanka Tóth
The subject lays emphasis on the basics and applications of chromatographic analysis: theoretical background and practice will be discussed in order to develop skills for method development and application of hyphenated techniques. (3 credits)

Elemental Analysis

BMEVESAA701

Dr János Madarász, Dr László Bezur
This introductory course deals with the modern instrumental analytical methods used for element analysis, trace element analysis. Topics like the basic principles of atomic absorption methods, ICP-OES method and ICP-MS method, the construction principles of instrumentation, the characteristic analytical parameters of the methods, and the principles of analytical method development are discussed (3 credits)

Elucidation of Organic Structures

BMEVESAA512

Dr András Simon
Introduction into the theory of ultraviolet/visible, infrared, mass and nuclear magnetic resonance spectroscopy.. Interpretation of ultraviolet/visible, infrared, EI-mass as well as one-dimensional ^{1}H and ^{13}C NMR spectra. Presentation of their application for the solution of practical problems. Presentation of their joint application in the elucidation of the structure of simple unknown compounds. (3 credits)

Organic Chemistry III

BMEVESKA504

Dr László Poppe, Dr Gábor Hornyánszki
Based on the knowledge of subjects Organic Chemistry I and II, this subject puts major emphasis on all aspects of chemical problems associated with chiral compounds. By systematic classification of all major stereochemical terms and stereoselective syntheses, this subject adds solid knowledge to the previously acquired bases in organic chemistry for the future chemical engineers of pharmaceutical and fine chemical industry (2 credits)

Theory of Testing Methods in Material Sciences

BMEVEFAA708

Dr Mihály Kállay
Introduction (the models of molecules, crystals, liquids, amorphous materials; interaction of materials with electromagnetic radiation); infrared and Raman spectroscopy; absorption UV-Vis spectroscopy; optical and electronic properties of solids; photoelectron spectroscopy (UPS, XPS, AES); NMR spectroscopy (molecular and solid state), X-ray diffraction (crystal, liquid, small angle); microscopy (SEM, TEM, AFM). (4 credits)

Chemical and Process Engineering

Chemical Production Control

BMEVEKTA707

László Rácz
Learning chemical processes from design operation and product delivery. Treatment of side products and wastes . Liabilty and operability study. Quality insurance.
Studying chemical processes from the design of operations all the way until product delivery. The subject also gives an overview about the treatment of side products and wastes. It also discusses liability and operability of chemical processes as well as the problems of quality insurance. (3 credits)

Computer Process Control

BMEVEKFA709

Dr Péter Mizsey
Process control gives funded knowledge about control theory and practice. Currently, computers are used everywhere, including in process control. Computers help, however, not only with controlling but also with designing of control structures. It enables the engineer to calculate controllability features and also modelling both steady state and dynamic processes. (3 credits)

Environmental Benign Chemical Processes

BMEVEVMA607

Dr Edit Székely
The course gives an overview of possibilities to be evaluated, understood and of the environ-mental impact of various technologies to be taken into account. Besides, through case studies the best available technique concept is demonstrated and discussed in details. Concepts and typical applications of separation methods from high vacuum to high pressure techniques is explained. (4 credits)

Hydrocarbon Technology and Catalysis

BMEVEKFA503

Dr Ákos Fürcht
To provide specialised knowledge about crude oil processing. To discuss the ecopolitical importance of crude oil, as one of the most important raw materials. To present crude oil produc-ing technologies and discuss the refinery flow scheme. To describe the catalyst management options, which may affect the profit possibilities. (5 credits)

Process Engineering

BMEVEVMA605

Dr Endre Rév
This Process Engineering course for BSc students targets three main clusters of basic Chemical Process Modelling knowledge, namely (i) flowsheeting, i.e. calculating steady state of complex chemical processes usually with recycling streams, (ii) practical selection and use of physico-chemical models for calculating phase equilibria and phase distribution, and (iii) basic numerical methods indispensable for engineers. An outlook to process synthesis problems and techniques is also provided. (5 credits)

Radiochemistry and Nuclear Energetics

BMEVEKFA502

Dr György Pátzay
Energy and matter. Atomic structure and bounding forces. Basic knowledge in nuclear energy production, fission and fusion. Types of radiations, alpha, beta gamma, neutron radiations. Detectors and nuclear measur-ements. Environmental radioactivity. Dosimetry and radiation protection. Nuclear power plants and nuclear fuel cycles. Radioactive wastes, waste treatments. Future of nuclear energy. (3 credits)

Industral Pharmaceutics

Elucidation of Organic Structures

BMEVESAA512

Dr András Simon
Introduction into the theory of ultraviolet/visible, infrared, mass and nuclear magnetic resonance spectroscopy.. Interpretation of ultraviolet/visible, infrared, EI-mass as well as one-dimensional 1H and 13C NMR spectra. Presentation of their application for the solution of practical problems. Presentation of their joint application in the elucidation of the structure of simple unknown compounds (3 credits)

Organic Chemistry III

BMEVESKA504

Dr László Poppe, Dr Gábor Hornyánszki
Based on the knowledge of subjects Organic Chemistry I and II, this subject puts major emphasis on all aspects of chemical problems associated with chiral compounds. By systematic classification of all major stereochemical terms and stereoselective syntheses, this subject adds solid knowledge to the previously acquired bases in organic chemistry for the future chemical engineers of pharmaceutical and fine chemical industry. (2 credits)

Organic Chemistry Laboratory Practice II

BMEVESKA605

Dr Gábor Hornyánszki
Students are to acquire a mastery of the methodology of lab-

oratory practice necessary to complete tasks in the fields of the pharmaceutical industry and the research-development sector of the organic chemical industry, and to successfully participate in the MSc studies. The aim of the laboratory practice is to carry out organic chemical reaction sequences, to learn about modern organic reactions, procedures and separation techniques, and to learn the requirements of conducting independent research (this involves the demonstration and practice of the structure elucidation of organic compounds, as well as the introduction of the methods of current organic chemical literature search, online search, the use of monographs and series, and the practice of the application of softwares). (5 credits)

Pharmaceutical Technology I.

BMEVESTA704

Dr Zoltán Hell

This subject gives an overview on the characteristic methods for the industrial synthesis of active pharmaceutical ingredients (API) based on the known technologies of Hungarian and other producers. The discussed fields are the followings: choice of the synthesis strategy, continuous development of the industrial technology from different aspects such as the environment protection, the quality assurance, the safety, the thrift and the protection of the copyright. The criteria of choosing the appropriate equipment, the technologies of the separation of APIs and their intermediates from natural raw materials (plants, animals) are presented. Aspects of the diminution of the waste products, waste treatment are also discussed. (2 credits)

Project Work

BMEVESZA777

Dr Antal Gajáry, Dr Alajos Grün

The aim of the subject is to present the research and development processes that result in industrial scale production. In the first half of the semester the elements and aspects of a development process are discussed. After that the students are given the opportunity to prove their skills in this field by working on a project divided into small groups (3 credits)

Technology of Pharmaceutical Materials

BMEVESTA607

Dr György Marosi

The aim of the subject is to introduce the students to the technology of pharmaceutical products including the relevant theory and practice. The characteristics of the applicable pharmaceutical excipients and drug delivery systems are also discussed. Understanding of the relevant structure-activity relationships are initiated based on the characteristics of the most important manufacturing methods of different types of pharmaceutical products. The analytical methods serve the understanding of this field are also introduced. After the successful completion of the subject one should be familiar with the theoretical bases of the medicine formulation and have a basic knowledge about each step of the manufacturing of pharmaceuticals and capable of discussing with the specialists of those fields. The subject is supposed to serve as a good basis for deeper research in the relevant field or can be a core of a BSc thesis. (3 credits)

Unit processes in Industrial Drug Synthesis

BMEVESTA606

Dr Ferenc Faigl

The subject deals with the typical chemical transformations, isomer separation techniques and scale-up processes of the pharmaceutical and fine chemical industries. Among the unit processes the special N-, O- and C-alkylations, C-C bond forming reactions (Claisen-, Dieckmann-, Knoevenagel- and Darzens-condensation, Vilsmeyer-formylation, reactions of polar organometallics, cross-coupling reactions), and selective reductions with inorganic and organic hydrides are discussed. The theory and methods of the separation and enrichment of optical isomers, as well as the application of dry technologies are discussed and illustrated through industrial examples (2 credits)

Unit processes in Industrial Drug Synthesis Laboratory Practice

BMEVESTA705

Dr Ferenc Faigl, Dr Zolán Hell

In the framework of the practice typical industrial scale synthetic technologies and processes are presented for the students. The theoretical background of the unit processes applied in the presented technologies has been discussed in the lectures of Unit Processes in Drug Synthesis" which is highlighted again during the practices. (4 credits)

Unit Processes of Organic Chemistry

BMEVESTA508

Dr György Keglevich

Presentation of the chemical transformations most commonly used in the chemical industry. The environmentally friendly aspects and implementations are given special emphasis. (2 credits)

Materials Science

Material Science Laboratory Practice

BMEVEMGA603

Dr Emilia Csiszár

Introduction; Characterization of plastics; Fracture mechanics; Determination of mechanical properties of plastics (tensile and bending tests); Thermal characterization of polymers; Fibre reinforced polymers; Characterization of fibrous materials; Investigations of layers; Electrochemical investigation of galvanic corrosion; Investigation of diffusion kinetics; (3 credits)

Metals and Metal Matrix Composites

BMEVEFAA602

Dr Kornél Májlinger, József Hári

During both their everyday life and professional work chemical engineers often meet a variety of traditional and modern metallic materials. The course provides important knowledge in the fields of natural science and engineering related to the production, processing and application of metallic functional materials. A further aim of the course is to present – from the perspective of materials science – the ability of metals, alloys and complex metallic matrices, as well as their associated systems, to satisfy the demands of the modern economy. (2 credits)

Modern Engineering Ceramics

BMEVEFAA601

Dr Alfréd Kállay-Menyhárd

During both their everyday life and professional work chemical engineers often meet a variety of traditional and modern ceramic materials. The course provides important knowledge in the fields of natural science and engineer-

ing related to the production, processing and application of ceramic functional materials. A further aim of the course is to present – from the perspective of materials science – the ability of modern industrial ceramics and their associated systems to satisfy the demands of the modern economy. (2 credits)

Nonconventional Materals

BMEVEFAA707

Dr András Szilágyi, Dr Krisztina László, Dr Zoltán Hórvölgyi
Metal foams. Shape memory alloys and polymers, special ceramics. Complex fluids. Gels and their application in drug delivery. Self-assembly. Responsive and other special nanocoatings. Aerogels. Materials with ordered porosity. Nanotubes. The course includes laboratory work; there are 4 compulsory laboratory practical classes in the aforementioned topics. (3 credits)

Physical Chemistry of Surfaces

BMEVEFKA603

Dr Krisztina László
Fundamentals of solid/fluid interfaces. The qualitative description of the surface layer, the concept of surface excess. Thermodynamics of the interfaces, surface tension and interaction potential. Interactions at solid/gas and solid/liquid interfaces. Adsorption isotherms, their interpretation (Langmuir, BET, Dubinin-Radushkevich and DFT models). Experimental methods, including calorimetry. Fractality. Particle size analysis.
Applied surface science: the role of interfaces in materials science, environmental and industrial processes. Heterogeneous catalysis, Pressure/Temperature Swing Adsorption. (3 credits)

Polyer Physics

BMEVEMGA511

Dr Béla Pukánszky
Introduction. Terms and definitions: monomer, polymer, homo- and copolymer. Structure of the polymer, segments, entanglement. Supramolecular structure, amorphous and crystalline materials. The individual chain. Shape, conformation, conformation distribution. The freely jointed chain model. Interactions, solutions, determination of molecular weight. Phases and physical states, thermomechanics. Rubber elastic state, thermodynamics, kinetics. Flow, rheology. Measurement of viscosity. Glassy state, fracture, polarization optics. Crystalline polymers, structure. Crystallization kinetics, melting. Structure-property correlations, plasticization (3 credits)

Project Work

BMEVEFAA777

Dr Alfréd Kállay-Menyhárd
The integration and application of the knowledge obtained by the students during their university studies through the design of a plant or factory manufacturing a given product. Demonstration of the complexity of problems related to the design and operation of a manufacturing plant. The course calls attention to problems rarely or not at all mentioned during other courses. The course helps students develop their ability to solve problems, make decisions and to present their results. (3 credits)

Testing Methods in Material Sciences

BMEVEMGA502

Dr Béla Pukánszky
Methods using the excitation of the electronic structure: XPS, UPS, AES, SIMS, absorption spectroscopy of solids; Methods using the excitation of the lattice: Thermal analysis, IR and Raman spectroscopy; Methods for studying the structure: XRD, SEM + EDX, SPM ((EC)-STM, (EC)-AFM, nanoindenter) (3 credits)

Theory of Testing Methods in Material Sciences

BMEVEFAA708

Dr Mihály Kállay
Introduction (the models of molecules, crystals, liquids, amorphous materials; interaction of materials with electromagnetic radiation); infrared and Raman spectroscopy; absorption UV-Vis spectroscopy; optical and electronic properties of solids; photoelectron spectroscopy (UPS, XPS, AES); NMR spectroscopy (molecular and solid state), X-ray diffraction (crystal, liquid, small angle); microscopy (SEM, TEM, AFM). (4 credits)

Polymer Technology

Machines and Moulds for Polymer Processing

BMEVEFAA705

Péter Müller
Introduction; Extrusion: components of an extruder, operation of an extruder, extruder screws; choosing the proper screw for a polymer; Characteristics of an extruder screw and its optimal operating point, film blowing, sheet extrusion; Wire coating, profile extrusion, filament extrusion, coextrusion; Injection moulding: Tool designing, simulation software; Special injection moulding techniques: Gas and water injection, Injection moulding on films, Injection moulding on textiles; Compression moulding machines and tools; Thermoforming machines and tools;
Practical work: Visits in manufacturing plants. (4 credits)

Polymer Additives

BMEVEMGA610

Dr János Móczó
Introduction; Changes taking place during the processing and application of plastics, chemical reactions, degradation, ageing; Degradation and stabilization; Light stabilization; PVC degradation and stabilization; Degradation and stabilization of other polymers; Lubricants; Fillers, surfactants, coupling agents; Polymer additives (impact modifiers, processing aids), their purpose and mechanism; Flame retardants; Blowing agents, colorants; Other additives; Further aspects of the use of additives, Additive packages, interaction of additives – PVC, polyolefins (2 credits)

Polymer Physics

BMEVEMGA511

Dr Béla Pukánszky
Introduction. Terms and definitions: monomer, polymer, homo- and copolymer. Structure of the polymer, segments, entanglement. Supramolecular structure, amorphous and crystalline materials. The individual chain. Shape, conformation, conformation distribution. The freely jointed chain model. Interactions, solutions, determination of molecular weight. Phases and physical states, thermomechanics. Rubber elastic state, thermodynamics, kinetics. Flow, rheology. Measurement of viscosity. Glassy state, fracture, polariza-

tion optics. Crystalline polymers, structure. Crystallization kinetics, melting. Structure-property correlations, plasticization. (3 credits)

Polymer Physics Laboratory Practice

BMEVEMGA509

Dr Béla Pukánszky
Introduction; Preparation and reactions of polymers; Qualitative analysis of polymers, Rheology; IR spectroscopy; Thermal analysis I; Thermal analysis II; Impact testing; Mechanical properties of polymers; Fibre-reinforced composites; Polymer foams, Welding of polymers (3 credits)

Polymer Processing

BMEVEMGA608

Dr Béla Pukánszky
Introduction; Rheology – flow, viscosity; The measurement of the characteristics of the melt (viscosity, elastic properties); Heat transfer processes; Extrusion – equipment, basic processes; Extrusion – dies, products; Injection moulding – equipment, the mould filling process; Injection moulding – the structure of injection moulded products; moulds; Extrusion and injection blow moulding, rotational moulding; Calendering; Welding and other operations; Processing of thermoset resins; Other processing technologies;
Laboratory classes: Introduction; Processing of polymer blends and particulate filled polymers; Extrusion of thermoplastics; Injection moulding of thermoplastics; Production of PVC compounds; Thermoforming; Thermo-retardation; Processing of thermoset resins: Epoxy resins, Compression moulding, Time-temperature-conversion correlations; Standard testing of rubbers (7 credits)

Project Work

BMEVEFAA777

Dr Alfréd Kállay-Menyhárd
The integration and application of the knowledge obtained by the students during their university studies through the design of a plant or factory manufacturing a given product. Demonstration of the complexity of problems related to the design and operation of a manufacturing plant. The course calls attention to problems rarely or not at all mentioned during other courses. The course helps students develop their ability to solve problems, make decisions and to present their results. (3 credits)

Theory of Testing Methods in Material Sciences

BMEVEFAA708

Dr Mihály Kállay
Introduction (the models of molecules, crystals, liquids, amorphous materials; interaction of materials with electromagnetic radiation); infrared and Raman spectroscopy; absorption UV-Vis spectroscopy; optical and electronic properties of solids; photoelectron spectroscopy (UPS, XPS, AES); NMR spectroscopy (molecular and solid state), X-ray diffraction (crystal, liquid, small angle); microscopy (SEM, TEM, AFM). (4 credits)

Textile Technology

Chemical Technology of Textiles I.

BMEVEMGA617

Dr Emilia Csiszár
Preparatory processes: desizing, scouring, bleaching, carbonizing; Mercerization and liquid ammonia treatment; Dyeing processes: fundamentals and methods; Textile printing; Laboratory classes: Identification of textile materials; Preparatory processes: desizing, scouring and bleaching; Dyeing of cellulosic fibres; Dyeing of wool; Dyeing of synthetic-polymer fibres; Textile printing; (7 credits)

Chemical Technology of Textiles II.

BMEVEFAA718

Dr Emilia Csiszár, Dr Judit Borsa
The main goal of the course is to give basic information about the most important chemical treatments for improving functional and aesthetic properties of textiles. The course gives a detailed account of the knowledge related to textile quality, the practical aspects of quality, as well as the environmental impact of the chemical finishing processes of textiles. (4 credits)

Chemistry of Dyes and Surfactants

BMEVESTA510

Dr András Víg
Demonstration of the classification, production, chemical and technological properties and use of dyes and surfactants applied in the textile and paper industry. Discussion of the application of different dyes and surfactants in the practice by means of industrial examples. (2 credits)

Colorimetry, Colormeasurement

BMEVEMGA515

Dr Sándor Csányi
The main goals of the course are to give basic information about the colours, colour spaces, methods of colour measurement and other related topics; to offer information about the colour measuring instruments and the measurement and evaluation of whiteness. (2 credits)

Fibre Forming Polymers

BMEVEMGA512

Dr Judit Borsa
An introduction to textile chemistry and technology, understanding the various applications of fibres. (2 credits)

Project Work

BMEVEFAA777

Dr. Alfréd Kállay-Menyhárd
The integration and application of the knowledge obtained by the students during their university studies through the design of a plant or factory manufacturing a given product. Demonstration of the complexity of problems related to the design and operation of a manufacturing plant. The course calls attention to problems rarely or not at all mentioned during other courses. The course helps students develop their ability to solve problems, make decisions and to present their results. (3 credits)

Theory of Testing Methods in Material Sciences

BMEVEFAA708

Dr Mihály Kállay
Introduction (the models of molecules, crystals, liquids, amorphous materials; interaction of materials with electromagnetic radiation); infrared and Raman spectroscopy; absorption UV-Vis spectroscopy; optical and electronic properties of solids; photoelectron spectroscopy (UPS, XPS, AES); NMR spectroscopy (molecular and solid state), X-ray diffraction (crystal, liquid, small angle); microscopy (SEM, TEM, AFM). (4 credits)

Description of MSc Courses

Biology, biotechnology

BMEVEMBM301

Dr Miklós Pécs
The subject gives an overview of modern biotechnology by focusing on its prominent areas of chemical industrial and engineering interest. After providing an introduction of cell biology and microbiology, the subject concentrates on the possibilities of biotechnology branches termed as white and green biotechnology. Furthermore, it discusses the most important bioindustrial unit operations and environmental bio-solutions. (3 credits)

Chemical Process Design and Control

BMEVEKFM101

Dr Péter Mizsey
To teach the students the elementary knowledge of chemical process design and control. The process design step is the creative challenge of the chemical engineer. Selection/determination of the proper design alternative is a difficult task. Investigation of the controllability of the process designed is also the part of the creative activity where the mutual effect of process and control should be considered. (4 credits)

Complex and Inorganic Chemistry

BMEVESAM101

Dr Ilona Kovács
The aim of the subject is to give a general knowledge in the field of the organometallic chemistry (classifications, structure, stability, reactivity) and to give more detailed information about the industrial applications of these compounds. The lectures have been structured in the traditional way – following the periodic table for the main-group element organometallics (alkali, alkali-earth, aluminum, tin, lead and silicon will be discussed in detail) and according to the nature of the ligand in transition-metal complexes. At the end of the course the industrial applied catalytic reactions (Heck, Suzuki, etc.) will be discussed. (2 credits)

Computational Chemistry

BMEVESAM301

Dr Dénes Szieberth, Tibor Höltzl
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. Practical examples for the solution of chemical- and physico-chemical problems by computer modeling will be done during the course. (3 credits)

Design of Experiments 2

BMEVEKFM209

Péter Kunovszki, Dr Sándor Kemény
To learn one of the most important and widely used statistical methods, the analysis of variance.
To deepen the knowledge attained in the introductory course about factorial designs. (3 credits)

Environmentally Benign and Catalytic Processes

BMEVEKFM210

Dr Edit Székely
The aim of the course is to give an overview of current environmental regulations, environ-mentally benign and industrially applied catalytic technologies and the trends of their devel-opment from the aspect of chemical engineers. The students gain insight to selected innovative processes and technologies and develop a broader understanding of the selection of a suitable technology for a given purpose. (5 credits)

Material Science Analysis Methods

BMEVESAM202

Dr Imre Miklós Szilágyi
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 students will get both theoretical knowledge and practical experience about a large number of analytical methods and instruments. (4 credits)

Materials science: traditional structural materials and polymers

BMEVEFAM110

Dr Alfréd Kállay-Menyhárd
Materials science explores the relationship between the processing technology, the structure and the properties of materials with the aim of meeting the requirements of specific applications. The goal of the course is to offer information about the structure, properties and behaviour of the most frequently used structural and functional solid materials. The course demonstrates the importance of the design, production and shaping of materials and products through real-life examples. The course discusses in detail the structure-property correlations of plastics, metals and ceramics,

as well as structural and functional solid materials based on renewable resources. This course also highlights the important similarities and differences between the studied structural materials. (4 credits)

Organic Chemical Technology II

BMEVESZM201

Dr László Hegedűs, Dr György Keglevich
Principles of environmentally friendly chemistry and chemical technology, up-to-date methods and techniques including catalytic transformations, sonochemistry and microwave-assisted chemistry, the use of green solvents and ionic liquids, phase-transfer catalysis. All these are shown via applications in industrial syntheses together with cost optimization, up-to-date analytical and separation technologies. (5 credits)

Organic Chemistry

BMEVESZM101

Dr Péter Huszthy
The aim of the subject is to get deep insight in organic chemistry at an advanced level. (4 credits)

Physical chemistry and structural chemistry

BMEVEFAM201

Dr Mihály Kállay
The course deals with the experimental and calculation methods and the related theoretical background that provide information about the structure and properties of molecules and molecule ensembles. (5 credits)

Modern Chemical Technology

Analytical and structure determination laboratory

BMEVESAM504

Dr Imre Szilágyi, Dr Róbert E Gyurcsányi
During the laboratory practices the students will become familiar with the state-of-the-art ana-lytical and structural chemistry instruments at the disposal of the Department of Inorganic and Analytical Chemistry (and at the Faculty of Chemical Technology and Biotechnology). They will learn the basics of advanced and coupled instrumental measurement methods of quantita-tive analysis, as well as of the study and elucidation of the molecular structure. (5 credits)

Applied Electrochemistry

BMEVESAM505

Dr Lajos Höfler
This course focuses on two major fields of electrochemistry: sensors and energy storage de-vices. Students can learn about theory, development and the analytical methods of some widely used electrochemical sensors, and batteries. The discussed topics cover the thermodynamics and kinetics of these devices. Various simulation methods to describe the response mechanism are included. (3 credits)

Biocatalysis

BMEVESZM704

Dr László Poppe
The aim of the subject is to provide high-level scientific and practical knowledge to the future chemical and bioengineers of chemical and biological industries (pharmaceutical, agro- and fine chemical, cosmetic and food industries) with special focus on the development of prob-lem solving skills related to chemical problems by using the tools of biotechnology. (2 credits)

Bioinformatics 2-proteomics

BMEVESZM501

Dr László Poppe
The aim of the subject is to provide high-level scientific and practical knowledge to the future bioengineers of chemical and biological industries (pharmaceutical, fine chemical, cosmetic, food, etc.) with special emphasis on the development of problem solving skills especially in the field of protein structure-activity relationships in the research and development. The course gives an overview of theoretical issues in proteomics, which is important to promote the practical applications, and provides insight into their applications in specific areas by computer practice. (4 credits)

Bioinorganic chemistry

BMEVESAM501

Dr Julianna Oláh
During the course students get acquainted with the combination of inorganic chemistry and biochemistry, the so-called bioinorganic chemistry, which draws great attention as a complete-ly new scientific field. Topics to be discussed: the role of the elements and inorganic com-pounds in biological processes, the formation of metal containing biocomplexes, the toxicity of some inorganic compounds, bioactive compounds with inorganic ions used in pharmaceuti-cal chemistry. (2 credits)

Biopolymers

BMEVEFAM212

Dr Emilia Csiszár
Biopolymers are polymers produced by 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 provides an introduction to the most significant biopolymers, their chemical structure, properties and most important applications. (4 credits)

Chemistry and Technology of Biomaterials

BMEVESZM708

Dr György Marosi
The subject aims at getting the students acquainted with the use of materials in biomedical applications, the excipients of biologically active materials, the concepts of the selection and preparation of biocompatible materials, their physical-chemical properties, and their use in the technology of medical products with special emphasis on the controlled release of drugs. The lectures include the classification of biomaterials; chemical and enzymatic reactions in relation to biomaterials (synthesis, modification and decomposition), macromolecular systems of envi-ronmental technologies, the relevant biodegradable polymers, macromolecular bases of pharmaceutical technologies (such as the preparation of nanocapsules, implants and their ap-plication). Special emphasis is put on the manufacturing technologies of biocomposites. All of these topics are established by the relevant basic summary regarding the considerations of material science, surface modification and analytics as well as physical chemistry of smart biomaterials. The seminars promote the understanding of the interactions between different classes of materials and many tissues of the human

body. Topics such as soft tissue replace-ment, biosensors, bio-devices and pharmaceuticals are included in the lectures as well. (2 credits)

Chromatography

BMEVESAM503

Dr György Horvai, Dr Viola Horváth, Dr Blanka Tóth
The basics and application fields of chromatography are presented in order to enable the students to learn method development and the use of hyphenated technics. (3 credits)

Conventional and Modern Forms of Energy Production

BMEVEKFM302

Dr György Pátzay
The aim of the subject is to introduce the theory and practice of energy production technolo-gies, conventional and modern forms of energy production to students. They will be informed about fossil, fissile and renewable energy sources and energy production technologies as well as about future fields of modern energy production, storage and distribution. (4 credits)

Environmental Toxicology

BMEVEMBM501

Dr Mónika Molnár, Dr Viktória Feigl
Environmental toxicology as part of the risk-based environmental management plays an increasingly important role. The main aim of the subject is to give an overview on the effect-based tools of the modern environmental risk management. The course covers both the theoretical background and the detailed practical aspects of environmental toxicology together with its applications in the risk assessment, risk management and in the environmental decision making. The topics discussed throughout the course are the following.
• The basics of environmental toxicology, qualitative and quantitative assessment of the toxicity effects of chemicals.
• The measurement of toxicity and other adverse effects, the classification of the test methods according to different aspects e.g. test-organism, size and type of tests, duration, and endpoints.
• The introduction of the most widespread related methodologies, their evaluation, statistics and interpretation. The use of ecotoxicity enables generic and site-specific risk assessment of chemicals; site- and land usage-specific assessment of contaminated land; integrated environmental monitoring; establishment of environmental quality criteria and priority setting as well as risk-based environmental management and decision making.
• Soil and soil-specific tests with emphasis on the importance of the Soil Testing Triad.
The typical applications of the environmental toxicity testing are discussed in details and are illustrated with interactive case studies. (3 credits)

Environmentally Benign Chemical Processes

BMEVEKFM501

Dr Edit Székely, Dr László Mika, Katalin Koczka, Ildikó Kmecz
The course gives an overview of possibilities to evaluate, understand and take into account the environmental impact of various technologies. Furthermore, through case studies the best available technique concept is demonstrated and discussed in details. Concepts and typical applications of separation methods from high vacuum to high pressure techniques are explained. (4 credits)

Hydrocarbon Technology

BMEVEKFM503

Dr Iván Gresits, Dr Ákos Fürcht
To discuss the importance of crude oil, as primary energy source. To present the crude oil pro-cessing technologies and discuss the common use of the products. To describe the challenges of the oil refining business (3 credits)

Inorganic Chemistry Laboratory Practice

BMEVESAM502

Dr Zoltán Benkő, Dr Dénes Szieberth
During laboratory exercises, physical and chemical properties of metallic and non-metallic elements and simple inorganic compounds are reviewed Students also gain knowledge on the solubilities of the elements and inorganic salts/compounds in water, acids and bases. Typical reactions of inorganic ions are studied via simple and complex qualitative analytical exercises. (3 credits)

Medicines

BMEVESZM502

Dr Ferenc Faigl, Ervin Kovács
The subject gives a breaf introduction to the medicinal chemistry and pharmacology. The fun-damental pharmacological definitions and concepts as well as the historical background of drug discovery and design are presented. Selected examples of drug activity at some common target receptors demonstrate the importance of the specific receptor-drug interactions and the importance of chemical modifications of the lead molecules to produce highly selective medi-cines. Concepts related to pharmacokinetics are introduced, such as absorption, distribution, metabolism and excretion. (3 credits)

Modern separation technologies

BMEVEKFM104

Dr Edit Székely, Dr László Mika, Katalin Koczka, Ildikó Kmecz
The subject gives an overview of environmentally friendly processes and unit operations of the chemical, biochemical and food industries. It deals with widely applied and currently re-searched technologies as well. During the course we will focus on how the development, se-lection and optimisation of a novel technology are influenced by environmental aspects be-sides selectivity and improved yield. By new separation technologies, adding different modifiers, solvents, etc. are not favoured and toxic adducts are one by one substituted to less harmful analogues. Modelling and design aspects will be also considered and explained through detailed description and evaluation of main application examples. (3 credits)

Nonconventional Materials

BMEVEFAM503

Dr András Szilágyi. Dr Krisztina László, Dr Zoltán Hórvölgyi
This course covers the following topics: Metal foams. Shape memory alloys and polymers. Special ceramics. Complex fluids. Gels and their application in drug delivery. Self-assembly. Responsive and other special nanocoatings. Aerogels. Materials with ordered porosity. Nanotubes. (3 credits)

Organic Chemical Technology

BMEVESZM503

Dr György Keglevich, Dr László Hegedűs
The subject discusses the main fields of organic chemical industry through many suitable ex-amples. (3 credits)

Petrochemistry

BMEVEKFM402

Dr Ákos Fürcht, Dr Iván Gresits
To provide specialised knowledge about the further processing of crude oil refinery products. To provide insight to the daily operation of petrochemical companies via several site visits. (6 credits)

Physical Chemistry of Surfaces

BMEVEFAM501

Dr Krisztina László
Fundamentals of solid/fluid interfaces. The qualitative description of the surface layer, the concept of surface excess. Thermodynamics of the interfaces, surface tension and interaction potential. Interactions at solid/gas and solid/liquid interfaces. Adsorption isotherms, their interpretation (Langmuir, BET, Dubinin-Radushkevich and DFT models). Experimental methods, including calorimetry. Fractality. Particle size analysis.
Applied surface science: the role of interfaces in materials science, environmental and industrial processes. Heterogeneous catalysis, Pressure/Temperature Swing Adsorption. (3 credits)

Plastics

BMEVEFAM502

Dr Béla Pukánszky, Dr János Móczó
To supply basic information about plastics for chemical engineering students. Encountering plastics is unavoidable these days both in everyday life and in engineering practice. The course provides the necessary basic knowledge for engineering practice, teaches ways to recognize the main sources of actual problems and offers methods to remedy them. The individual classes discuss the production, processing, behaviour and properties of plastics, as well as related environmental issues. (5 credits)

Process Engineering

BMEVEKFM211

Dr Endre Rév
This Process Engineering course targets ideas and basic techniques of Process Structure Design, also called Chemical Process Synthesis. The most important problems and solution methods of process synthesis are presented. Included are detailed discussion of energy recovery networks and mass exchange networks, distillation sequencing, energetically efficient continuous rectification variants, continuous distillative separation processes applicable to azeotropic and near boiling mixtures. Optionally, depending on progress, feasibility methods applicable in assigning batch distillation of azeotropes, as well as the most important heuristics of scheduling are also discussed. (4 credits)

Radiochemistry and Nuclear Energetics

BMEVEKFM502

Dr György Pátzay, Tibor Nagy, Dávid Havasi
Energy and matter. Atomic structure and bounding forces. Basic knowledge in nuclear energy production, fission and fusion. Types of radioations, alpha, beta gamma, neutron radiations. Detectors and nuclear measuerements. Environmental radioactivity. Dosimetry and radiation protection. Nuclear power plants and nuclear fuel cycles. Radioactive wastes, waste treat-ments. Future of nuclear energy. (3 credits)

Unit Processes of Organic Chemistry

BMEVESZM207

Dr György Keglevich, Dr Nóra Kiss
Presentation of the chemical transformations most commonly used in the chemical industry. The environmentally friendly aspects and implementations are given special emphasis. (2 credits)

Curriculum of MSc Subjects
Environmental Engineering

Subject			hours/week			
Name	Code	Credits	1	2	3	4
Probability Theory and Statistics M1		4	2/2/0			
Physics K3M		4	3/0/0			
Applied Chemistry		4	2/2/0			
Environmental Microbiology and Biotechnology		3	2/0/0			
Engineering Ecology		3	2/0/0			
Economics		2	2/0/0			
Environmental Law		2	2/0/0			
Communication		2	2/0/0			
Risk Assessment, Recovery of Industrial and Environm. Disasters		3	2/0/0			
Transport Equations M11		4		3/1/0		
Technology Management		2		2/0/0		
Environmental Management		2		2/0/0		
Environmental Analytical Chemistry		3		2/0/1		
Design of Experiment		3		2/1/0		
Green Chemistry and Catalysis		3		2/0/0		
Biochemical Engineering Processes and Unit Operations		3		2/0/2		
Sustainable Environmental and Natural Resource Management		3		2/0/0		
Numerical Modelling of Fluid Flow in Environmental Technology		3		1/1/0		
Case Studies in Environmental Impact Assessment and Auditing		3			1/1/0	
Modelling of Environmental Systems		3			2/1/0	
Modern Environment-friendly Transportation Systems					2/0/0	
Environmental Toxicology		3			2/0/1	
Compulsory optional subjects		6			6/0/0	
Thesis Project		25				0/0/25

Curriculum of MSc Branch Subjects
Environmental Engineering

Subject		
Name	Code	Credits
Branch of Environmental Management		
Local Sustainability Programs		3
Environmental Marketing		3
Waste Management		3
Environment Management Systems		3
Environmental Performance Evaluation		3
Environmental Strategic Planning		3
Environmental Valuation and Risk Assessment		3
Spatial Development		3
Branch of Environmental Technology		
Basics of Control Engineering		3
Sustainable Environmental Processes		3
Renewable Energy Sources		3
Environmental Process Instrumentation and Control		3
Surface water and Groundwater Monitoring		3
Technical Acoustic and Noise Control		3
Waste Management Techniques		3
Case Studies in Air Pollution Control		3