UNIVERSITY OF DEBRECEN,
CENTRE OF ARTS, HUMANITIES, AND SCIENCES,
FACULTY OF SCIENCE AND TECHNOLOGY

Bachelor of Chemical Engineering
(BSc degree program)
H-4010 Debrecen, P.O. Box 95, Hungary
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Internet: http://englishstudies.sci.unideb.hu
I. General Description of the Chemical Engineering, BSc Program

Objectives and Perspectives

Our objective is to train professionals who possess the general knowledge, technical intelligence, mastery of at least one foreign language, the basics of natural, social and engineering sciences, which are essential for the practice of the chosen profession.

It is likewise important that students acquire the most essential skills in technology and safety, environmental protection, management and social sciences. Concrete practical methods as well as the capability to apply acquired skills will help them to get accustomed to the professional requirements and standards of their future workplace. They will be capable of understanding/controlling production processes, preparing quality insurance and technical services and solving tasks regarding planning and development.

Through the learning of basic legal, economic and management skills, students will be trained to carry out projects concerning production and marketing. In addition, senior students will possess the necessary theoretical and practical expertise to solve problems appearing in the processes of the chemical and related industries, can furthermore plan and operate complex technological systems and carry out research and development tasks.

Requirements

<table>
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<th>Duration of studies: 7 semesters</th>
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<tr>
<td>Number of teaching (contact) hours: 1,800</td>
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<td>Number of required ECTS credits: 210</td>
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Compulsory subjects

*General and scientific foundations* (mathematics, physics, general and inorganic-, macromolecular-, colloid- and bio- chemistry)

*Economic and human sciences* (basics of legal, economic and management sciences)

*Basics of professional knowledge* (physical- and analytical- chemistry, informatics and computer models, mechanics, unit operations, chemical technology, safety)

*Higher engineering* (petrol chemistry, plastics, environmental technology, radiochemistry, quality management, instrumental analytical methods and quality assurance)

*Thesis*

Elective subjects

e.g. chemical technology of hi-tech materials, production of plastics etc.

Graduate Study Opportunities

- *MSc programs in development:*
  - Chemistry
  - Chemical Engineering
  - MSc in Materials Engineering
  - MSc in Materials Science
  - Environmental Engineering
  - Environmental Science
  - Bioengineering

- PhD in Chemistry (see p. Y)
II. Description of Study Program

After graduation, a first level degree chemical engineer should

- have a knowledge of relevant basic sciences (mathematics, chemistry, physics) to help understand, describe and solve chemical engineering phenomena.
- understand the basic principles underlying chemical engineering: material and energy balances, equilibrium, rate processes (chemical reaction, mass, heat, momentum transfer) and be able to use them to set up and to solve (analytically, numerically, graphically) a variety of chemical engineering problems.
- understand the main concepts of process control
- understand the principles underlying modern methods of chemical analysis
- be able to plan, perform, explain and report simple experiments
- have a knowledge of relevant literature and data sources
- be able to take a structured approach to safety and health
- understand the concept of sustainability and be aware of the central role chemical engineering plays in preventing and solving environmental problems
- have an ability to analyze complex problems in the chosen area of specialization
- have some experience in using appropriate software
- be able to perform appropriate design in chosen specialization
- be able to calculate process and project economics
- have some industrial experience – gained before or between the semesters

History of Chemistry and Chemical Engineering at Debrecen University.

The teaching of natural sciences at the University of Debrecen dates back to 1949 when the Faculty of Sciences was established in Debrecen by the Hungarian government. During the integration process of 2000 the Faculty of Sciences became one of the most populous faculties of the University of Debrecen. It cultivates mediates and teaches a number of fields of biology, physics, geography, chemistry, environmental science and mathematics at an advanced level. In these disciplines the faculty plays a major role in the eastern Hungarian region while its influence reaches beyond borders and influences Hungarian communities in the neighboring countries. One can choose from 22 different majors as a full time student at the university. In addition the Faculty of Sciences has basic college level training, subsidiary basic training and specialised teacher training in 20 different majors. The training of the students focuses on the applicability of the newest results in science and technology.

Technical academic education has been improved constantly since the 1960s. Nowadays the Faculty of Engineering is the most significant center of academic education in the eastern region. The applicants can choose from 10 majors while the preparation of the university level engineer training is in progress. During the integration process of the university the instructors of the faculty provide engineering knowledge for other faculties. Chemist and chemistry teacher training is continuous since the establishment of the Faculty of Sciences relying on the staff above mentioned institutes. Chemical engineer training at
college level was started in 1999 by the cooperation of the Faculty of Sciences namely the Institute of Chemistry and the faculty of Engineering.

The prognosis of regional and national demand for graduates of the new academic courses the possible documentation/presentation of the demand for employment.

The setting up of the chemical engineering BSc is justified by the significant changes in the economic technical and social environment of the region. Beside heavy industry middle sized self employed industries have appeared. This cause for the development of engineering training that includes economic knowledge necessary for the maintenance of the above mentioned economic structure. Industrial companies within the reach of Debrecen have concrete demand for practice oriented chemical engineers who relying on their concrete knowledge are capable of adapting and controlling complex chemical technologies. Chemical engineers who receive their diploma at other universities of the country will find employment in western Hungary so there is not enough well trained professionals for companies in Eastern Hungary. As a regional center of higher education in Hungary the University of Debrecen could train engineers for the plastic food processing and pharmaceutical industries. Due to the change of the economic structure small and middle scale companies will emerge in the field of plastic manufacturing and the processing of agricultural products in the near future. The direct aim of the widening of the educational and training spectrum at the university is to ensure the required number of professionals in these economic sectors.

The training objective of the chemical engineering BSc is to improve the supply of engineering professionals in the region, to keep those with a secondary school degree from migrating. Our objective is to train professionals who possess the general knowledge, technical intelligence, mastery of at least one foreign language, the basics of natural, social and engineering sciences, which are essential for the practice of the chosen profession.

It is likewise important that students acquire the most essential skills in technology and safety, environmental protection, management and social sciences. Concrete practical methods as well as the capability to apply acquired skills will help them to get accustomed to the professional requirements and standards of their future workplace. They will be capable of understanding/controlling production processes, preparing quality insurance and technical services and solving tasks regarding planning and development.

Through the learning of basic legal, economic and management skills, students will be trained to carry out projects concerning production and marketing. In addition, senior students will possess the necessary theoretical and practical expertise to solve problems appearing in the processes of the chemical and related industries, can furthermore plan and operate complex technological systems and carry out research and development tasks.

Relying on the previous negotiations with companies of the region we forecast that there will be an annual demand for 50-60 graduate chemical engineers.

Graduate chemical engineers will specialize for practical task solving which means that they will be able to fill in positions of workmaster or higher at various corporations, factories and firms. The filling of these positions with well trained professionals is demanded by companies of Eastern Hungary for this reason there is a clear and real need for the training of such qualified labourers is. The starting of such academic course makes further education possible for those who cannot afford to begin studies at more distant universities in Hungary.
We are not planning to start different specializations within the chemical engineering BSc at the Faculty of Science at the University of Debrecen. Relying on the acquired BSc diploma we are planning to offer a great variety of MSc courses. This way the students can directly carry on MSc studies at the following branches:

Chemical Engineer MSc
Chemistry MSc
Environmental Engineer MSc

The training of chemists is already in progress at the University of Debrecen. The accreditation of the environmental engineer MSc is also at advanced stage. The MSc level chemical engineering training will happen while we switch over to two level training (BSc, MSc). At MSc level all three majors we will offer wide range of specializations demanded by the needs of the region.

The curriculum and subject thematic of the chemical engineering BSc course to be started was compiled in such a way that the outstanding students will receive in depth knowledge of mathematic, scientific and engineering disciplines during their training. The outstanding students will be guided towards doing student research at the departments. They will be able to join the Hatvani István special college a special institution for talent nurturing. the Hatvani István special college is interdisciplinary academic center at the University of Debrecen that aims to prepare students of great talent and outstanding results through the following means:

Tutorial training: Each member of the college has a tutor who is a mentor and patron and navigates him or her through the labyrinth of science.
General lecture: 3-4 times in a semester an outstanding representative of a particular field of science holds a lecture before the members of the special college. Attendance is required and involvement is expected of them.
Language courses: During the semester and in the summer holyday offers language courses to encourage application for international scholarships and research trips and to help the students to come together and communicate their thoughts about themselves and the world.
Special lectures: Every semester a predetermined field of study (relying on the needs of the members) will offer lectures that will place emphasis on interdisciplinary knowledge.
Seminars: the leaders of the special college will ask outstanding researcher to hold seminar and practice for a specific group of college members (relying on the topics of their diploma works and professional interest).
Special college research topic: the branches will establish individually and jointly research topics that can be dealt with on a collective basis.
Student conferences: The special college members give presentations to each other the aim of which is to learn about fields other than their own and consequently to create a stronger community.

The training of chemists and chemical engineers is ran through the participation and cooperation of two faculties, namely the Faculty of Science and Technology and the Faculty of Engineering of the University of Debrecen. The material requirements of the training are ensured by the infrastructure located at the Institute of Chemistry and the Faculty of Engineering. 2 corresponding members of the academy, 6 doctors of the academy, 5 candidates of science and 11 PhD doctors take part in the training. The planned number of the students at the chemical engineering BSc is 40 people.
### III.
#### III. 1. Outline of the Study Programme
Chemical Engineer BSc

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<th>Course title</th>
<th>Code</th>
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<th>Credits</th>
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Symbols:  
a – acceptance (no grade), g – practical, f – mid semester grades (practical)  
k – examination (written, or oral), z – Subjects of the Final Exam.
III. 2. Subject programmes

1. Mathematics I.

Code: TMBE0606
Classes/week: 4 hours of lecture
ECTS Credit Points: 5
Prerequisites: None
Lecturer: Muzsnay, Zoltán

Topics: Real and complex numbers, basic notions of combinatorics. The calculus of functions of one variables: limits, continuity, derivative applications and interpretations. Series in one variable with emphasis on Taylor series. An introduction to the principles and methods for solving first order ordinary differential equations. The calculus of functions of several variables with an introduction to vector calculus: limits, continuity, partial derivatives, gradients, differentials. Riemann integration, applications to area, volume, etc., and basic methods for conversion of integrals including change of variable, substitutions, partial fractions, integration by parts, improper integrals. Multiple integrals. Vector spaces, basis and dimension, rank of a system. Matrix algebra including basic algebraic operations, determinants, inversion, rank. Solution of systems of linear equations. Linear transformations, eigenvalues, and eigenvectors.

Compulsory/Recommended Readings:

Code: TMBG0606
Classes/week: 3 hours of problem-solving seminar
ECTS Credit Points: 2
Prerequisites: None
Lecturer: Muzsnay, Zoltán

Topics: Real and complex numbers, basic notions of combinatorics. The calculus of functions of one variables: limits, continuity, derivative applications and interpretations. Series in one variable with emphasis on Taylor series. An introduction to the principles and methods for solving first order ordinary differential equations. The calculus of functions of several variables with an introduction to vector calculus: limits, continuity, partial derivatives, gradients, differentials. Riemann integration, applications to area, volume, etc., and basic methods for conversion of integrals including change of variable, substitutions, partial fractions, integration by parts, improper integrals. Multiple integrals. Vector spaces, basis and dimension, rank of a system. Matrix algebra including basic algebraic operations, determinants, inversion, rank. Solution of systems of linear equations. Linear transformations, eigenvalues, and eigenvectors.

Compulsory/Recommended Readings:
2. Mathematics II.

Code: TMBE0607  
Classes/week: 2 hours of lecture  
ECTS Credit Points: 3  
Prerequisites: Mathematics I. (TMBE0606), Mathematics seminar I. (TMBG0606)  
Lecturer: Muzsnay, Zoltán  


Compulsory/Recommended Readings:  

Code: TMBG0607  
Classes/week: 3 hours of problem-solving seminar  
ECTS Credit Points: 2  
Prerequisites: Mathematics I. (TMBE0606), Mathematics seminar I. (TMBG0606)  
Lecturer: Muzsnay, Zoltán  


Compulsory/Recommended Readings:  

3. PHYSICS FOR ENGINEERS I.

Code: TFBE2111  
Classes/week: 2 hours of lecture and 1 hour of follow up seminar  
ECTS Credit Points: 3  
Prerequisites: none
Lecturer: Erdélyi, Gábor


Compulsory/Recommended Readings:

4. PHYSICS FOR ENGINEERS II.

Code: TFBE2113
Classes/week: 2 hours of lecture and 1 hour of follow up seminar
ECTS Credit Points: 3
Prerequisites: TFBE2111
Lecturer: Erdélyi, Gábor

Topics: Phenomena and physical quantities of electrostatics: Coulomb’s law, electric intensity, Gauss’s law, electric potential, electric dipoles; conductors and isolators in electric fields; influence, capacitors, dielectrics, polarization. Current, electric circuits: resistivity, Ohm’s law; electric currents in metals, semiconductors, liquids and in gases. The magnetic field: forces in magnetic fields, the flux density, Ampere’s law. Induction: Faraday’s law, Lenz’s law, magnetic properties of matter; alternating currents and electromagnetic vibrations. Light and electromagnetic waves: phenomena of interference, diffraction and polarization; propagation of light, absorption and scattering. The failures of classical physics: thermal radiation, photoelectric effect; the Rutherford experiment, the Bohr model, the Franck-Hertz experiment. Particle-wave dualism: de Broglie’s relation, matter waves, wave function, the Schrödinger-equation, tunneling, chemical bond, uncertainty principle. Band model of solids, conduction phenomena in semiconductors, superconductivity, lasers. Radioactivity: radiations, the law of radioactive decay. Nuclear structure: properties of nuclei, nuclear fission and fusion; reactors. Elementary particles, fundamental interactions, basic terms of cosmology.

Compulsory/Recommended Readings:
5. GENERAL CHEMISTRY I.

Code: TKBE0111 and TKBL0111
Classes/week: 2 hours of lecture, 1 hour of follow up seminar and two hours of laboratory practice
ECTS Credit Points: 5
Prerequisites: none
Lecturer: Nagy, Miklós


Compulsory/Recommended Readings:

6. GENERAL CHEMISTRY II.

Code: TKBE0112 and TKBL0112
Classes/week: 2 hours of lecture, 1 hour of follow up seminar and two hours of laboratory practice
ECTS Credit Points: 5
Prerequisites: TKBE0111 and TKBL0111
Lecturer: Nagy, Miklós

Topics: Principles of chemical equilibrium, homogeneous and heterogenous equilibra, the equilibrium constant expression, the significance of the magnitude of an equilibrium constant, altering equilibrium conditions: Le Châteliers Principle. Acids and bases. Early theories (Arrhenius, Lux, Lewis). Bronsted-Lowry theory of acids and bases, the self-ionization of water and the pH scale. Strong acids and strong bases,

Compulsory/Recommended Readings:

7. INORGANIC CHEMISTRY
Code: TKBE0211, TKBL0211
Classes/week: 2 hours of lecture and 2 hours of laboratory practice
ECTS Credit Points: 3 + 1
Prerequisites: TKBE0111, TKBL0111
Lecturer: Micskei, Károly

Topics: The physical and chemical properties of the p-field elements, occurrence, basic industrial production. Survey of the structure of the compounds, chemical (especially acid-base and redox) properties considering hydrides, halides, oxides, acids and sulfides in particular. The biological effects of the elements and compounds. Laboratory preparation of the most important compounds and the chemical background of their industrial production. Survey of the compounds and ions as ligands, introduction to analytical chemistry. Practical application of the important elements and compounds in the laboratory and industry. Alkali- and alkali-earth metals and their important compounds. Formation of complex compounds, the coordinative bond, types, important properties. The coordination behavior of the metal ions and ligands. General description of the transition metals, properties and their well-known compounds. Important representatives of organometallic compounds, biological aspects of inorganic chemistry.

LABORATORY PRACTICE:
Work schedule in the laboratory and acquainted with the laboratory instruments. Mass, volume and density measurements, titrimetry-based measurements. Basic laboratory methods: dissolution, dilution, decantation, filtration, gas production, use of gas cylinders, extraction, distillation methods. Preparation of some simple chemical compounds. Reactions of important cations and anions, qualitative analysis.

Compulsory/Recommended Readings:
8. ORGANIC CHEMISTRY I.
Code: TKBE0301
Classes/week: 2 hours of lecture, 1 hour of problem-solving seminar
ECTS Credit Points: 4
Prerequisites: General chemistry (TKBE0111, TKBL0111)
Lecturer: Antus, Sándor

Topics: Classification, nomenclature and structure of organic compounds, their physical and chemical properties, preparation and reactivity according to their functional groups and structure-chemical reactivity relationship. The lecture is supplemented by a weekly seminar (1 hour) that follows the lecture and helps its adoption. Summary of basic organic chemistry concepts. Occurrence, nomenclature, preparation and reactions of alkanes, cycloalkanes, alkenes, cycloalkenes, alkynes, mono- and polycyclic aromatic hydrocarbons, alkyl halides, alcohols and phenols, ethers and certain organometallic derivatives.

Compulsory/Recommended Readings:

9. ORGANIC CHEMISTRY II.
Code: TKBE0312 and TKBL0312
Classes/week: 2 hours of lecture, 1 hour of problem-solving seminar, 3 hours of laboratory practice
ECTS Credit Points: 6
Prerequisites: Organic chemistry I. (TKBE0301)
Lecturer: Antus, Sándor

Practice: Basic procedures: crytallization, distillation, extraction, TLC and coloumn chromatography. Simple chemical reactions using micro and semi micro methods. Basics of literature search of synthetic procedures.

Compulsory/Recommended Readings:

10. MACROMOLECULAR CHEMISTRY
Code: TKBE0611
Classes/week: 2 hours of lecture
ECTS Credit Points: 3  
Prerequisites: Organic chemistry II. (TKBE0312)  
Lecturer: Kéki, Sándor


Compulsory/Recommended Readings:  

11. COLLOID CHEMISTRY

Code: TKBE0404  
Classes/week: 2 hours of lecture  
ECTS Credit Points: 3  
Prerequisites: Physical Chemistry I. (TKBE0401)  
Lecturer: Bányai, István


Compulsory/Recommended Readings:  
12. BIOCHEMISTRY

Code: TBBE0313
Classes/week: 1 hour of lecture
ECTS Credit Points: 2
Prerequisites: Organic Chemistry II. (TKBE0312)
Lecturer: Gyémánt, Gyöngyi

Topics: Protein structure and function; Oxygen-transporting proteins; Enzymes and mechanisms of enzyme action; Structure and function of biological membranes; Carbohydrate metabolism: glycolysis and glyconeogenesis, glycogen metabolism, the pentose phosphate pathway; Fatty acid metabolism; Amino acid metabolism; Structure of RNA and DNA. Movement of genetic information.

Compulsory/Recommended Readings:

13. ECONOMICS I.

Code: MFKGT31V04
Classes/week: 2 hours of lecture and 1 hour of problem solving seminar
ECTS Credit Points: 4
Prerequisites: none
Lecturer: Égri, Imre, T. Kiss, Judit


Compulsory/Recommended Readings:
I. Samuelson, Nordhaus: Economics I. II.
14. MANAGEMENT

Code: MFMEN31V03
Classes/week: 2 hours of lecture and 1 hour of problem solving seminar
ECTS Credit Points: 4
Prerequisites: none
Lecturer: Pokorádi, László, Varga Emilné Szűcs, Edit

Topics: History of management (classical school, bureaucratic management, scientific management, administrative management, human relations school, human resources school, integrating the management theories, emerging management positions). What managers and organizations do (managers and organizations, strategic thinking, planning and control, organizing work teams and structures, organizational culture). Managing people (perception, learning and personality, motivation and organizational learning). Managing relationships (communications, interpersonal relations, building groups into teams). Leading and managing practices (problem solving, power and organizational politics). Managing change (stress at work, change and organizational development, origins and methods of management and OB theories). The basics of strategic management (strategic analysis, strategy formulation, strategy implementation). The basics of Total Quality Management (customer focus, process improvement, total involvement, developing the quality strategy).

Compulsory/Recommended Readings:

15. STATE ADMINISTRATION AND LAW

Code: MFAJI31V02
Classes/week: 1 hour of lecture and 1 hour of follow up seminar
ECTS Credit Points: 2
Prerequisites: none
Lecturer: Zentay, Isvánné

Topics: The constitutional basics of the municipality structure, state organisation, municipality levels, basic civil rights, the historical overview of the civil institutions. Operation of municipalities, their organisation system, statutory supervision, and the major rules and regulations of the municipal, state and administrative procedures. The characteristics of the Hungarian municipality structure in light of the EU municipality systems. The introductory lectures include legal rudiments and the structure of the legal system. The knowledge of corporate law, commercial law and proprietary rights. The major responsibility forms (compensation, indemnification) related to the activity, the general rules and regulations of concluding a contract.
Compulsory/Recommended Readings:
1. Fogarasi, Ivancsics, Kiss: The handbook of the local authorities Union Publishing house, Debrecen (1997)
2. Hungarian acts and decrees

16. ECONOMICS II.

Code: MFKGT32V04
Classes/week: 2 hours of lecture and 1 hour of problem solving seminar
ECTS Credit Points: 4
Prerequisites: MFKGT31V04
Lecturer: Egri, Imre, T. Kiss, Judit

Topics: Measuring national income and output (real vs. nominal GNP, GDP, NNP, NDP, the problem of double counting) Economic growth. Consumption and Investment. IS model. Economic role of government (externalities). Fiscal policy and output determination. The effectiveness of fiscal policy. The role of money in the economy, the evolution of money, central bank, commercial banking, the supply and the demand for money. Monetary policy (varieties and problems of monetary policy). IS-LM analysis: the integration of the goods and money market models. Aggregate demand and supply. Labor market. Unemployment and inflation.

Compulsory/Recommended Readings:
1. Samuelson, Nordhaus: Economics II. III.

17. ENGINEERING ETHICS

Code: MFMRE31X03
Classes/week: 2 hours of lecture
ECTS Credit Points: 3
Prerequisites: none
Lecturer: Tiba, Zsolt

The origin of the word: engineer and progress of the engineering. The history of the education of the engineering in Hungary. The task, the profession and the attitude of engineer. The criterion of engineer. The concept and content of engineering ethics. The relation between technology and ethics. Engineer and the rate of living. Engineer and the society. Engineer and the environment. Engineer and the energy. Engineering ethics (disciplinary) codex.

Compulsory/Recommended Readings:
18. BUSINESS AND INVESTMENT ORGANISATION

Code: MFSZE31X03  
Classes/week: 2 hour of lecture  
ECTS Credit Points: 3  
Prerequisites: none  
Lecturer: Zentay, Isvánné

Topics:  
The concept of investment, its types and groups. The process of organising investments, their documentation, analysis and the introduction of the related methodologies and technologies. Participants of investments. Financing and activating investments. Investment policy from the point of view of the investors and the national economy. The concept of tenders, and their types. The application of the public procurement act in case of investments. The general rules and regulations of the public procurement procedures and tenders.

Compulsory/Recommended Readings:  

19. QUALITATIVE AND QUANTITATIVE ANALYSIS

Code: TKBE0511 and TKBL0511  
Classes/week: 2 hours of lecture and 4 hours of laboratory practice  
ECTS Credit Points: 6  
Prerequisites: TKBE0211, TKBG0211  
Lecturer: Farkas, Etelka

Topics:  
PRACTICE: Classification of ions by precipitation reactions. Classical quantitative analytical methods: volumetric titrations based on acid-base equilibria, complex formation, precipitation reactions and redox equilibria; gravimetric analyses.

Compulsory/Recommended Readings:
1. G. Svehla: Vogel’s Qualitative Inorganic Analysis, John Wiley and Sons, New York, 1994

20. INSTRUMENTAL METHODS OF ANALYSIS

Code: TKBE0512, TKBL0512
Classes/week: 2 hours of lecture and 3 hours of laboratory practice
ECTS Credit Points: 5
Prerequisites: TKBE0511 and TKBL0511
Lecturer: Posta, József, Farkas, Etelka


Compulsory/Recommended Readings:
21. PHYSICAL CHEMISTRY I.

Code: TKBE0401  
Classes/week: 2 hours of lecture, 2 hours of problem-solving seminar  
ECTS Credit Points: 4  
Prerequisites: TKBE0211, TKBL0211  
Lecturer: Joó, Ferenc, Gáspár, Vilmos


PROBLEM SOLVING SEMINAR  
Goal: helping the students to work out checklists of key ideas and solve exercises and problems closely related to the subject of the lecture on a weekly schedule.

Compulsory/Recommended Readings:  

22. PHYSICAL CHEMISTRY II.

Code: TKBE0403 and TKBL0403  
Classes/week: 2 hours of lecture, 2 hours of laboratory work  
ECTS Credit Points: 4  
Prerequisites: TKBE0401  
Lecturer: Joó, Ferenc, Gáspár, Vilmos and Nagy, István


LABORATORY EXCERISES (5 hours / week – for 6 weeks only):
1. Determination of the heat of combustion in a bomb calorimeter. 2. Liquid-gas equilibrium and determination of the heat of evaporation. 3. Spectrophotometric determination of the equilibrium constant of the \( \text{I}_2 + \text{I}^- = \text{I}_3^- \) reaction. 4. Determination of the mean activity coefficient of a strong electrolyte by measuring electrochemical cell potential. 5. Determination of the dissociation constant of a weak electrolyte by conductometric measurements based on Ostwald’s law of dilution. 6. Kinetics of second order reactions: determination of the rate constant of the hydrolysis of esters.

Compulsory/Recommended Readings:

23. MATERIALS OF CONSTRUCTION

Code: TKBE1211
Classes/week: 2 hours of lecture
ECTS Credit Points: 3
Prerequisites: TKBE1111, TKBL1111
Lecturer: Deák, György

Topics:

Compulsory/Recommended Readings:

24. PLASTICS AND PROCESSING I.

Code: TKBE1212
Classes/week: 2 hours of lecture
ECTS Credit Points: 3
Prerequisites: Macromolecular chemistry (TKBE0611)
Lecturer: Deák, György

**Compulsory/Recommended Readings:**


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**25. INFORMATICS FOR ENGINEERS**

**Code:** TKBG0911  
**Classes/week:** 2 hours of lecture  
**ECTS Credit Points:** 3  
**Prerequisites:** TMBE0607, TMBG0607  
**Lecturer:** Kuki, Ákos  


**Compulsory/Recommended Readings:**

2. Carol Brown: Microsoft Office XP Plain & Simple, Microsoft Press, Redmond 2004

26. PROCESS CONTROL I.

Code: MFFOI31V04
Classes/week: 2 hours of lecture, 2 hours of follow up seminars
ECTS Credit Points: 4
Prerequisites: TKBE0401
Lecturer: Gulyás, Lajos

Course Description:

References:

27. PROCESS CONTROL II.

Code: MFFOI32V02
Classes/week: 2 hours of seminars
ECTS Credit Points: 2
Prerequisites: MFFOI31V04
Lecturer: Gulyás, Lajos
Course Description:
Knowledge of process control with chemical engineering examples. Using Matlab Control
SystemToolbox and Simulink for process control. Mathematical modeling of chemical
processes. Linearization of nonlinear models. Description of Linear Time-invariant
Systems with Differential equations. Constructing models: State-space models, Transfer
functions, Zero-pole-gain models and Frequency response models. SISO and MIMO
systems. Solution of state-space equation in time-, Laplace- and frequency domain.
Sampled data systems. Syntheses of control loop. Designing compensators. Two-position
controlling.

References:
1979.
2007.

28. MECHANICS FOR CHEMICAL ENGINEERS I.

Code: MFVGE31V03
Classes/week: 2 hours of lecture and 1 hour of follow up seminar
ECTS Credit Points: 3
Prerequisites: TFBE2113
Lecturer: Horváth, Róbert

It reviews the fundamental rules of the formal requirements of the technical drawing, the
drawing of the projections, profile and sectional drawing of the components. After that it
deals with the drawing of standardized machine elements and the concept of manufacturing
tolerance and fitting, dimensional specification, geometrical and positioning tolerance,
surface irregularity and the rules of elaboration of the workshop drawing.
In seminar there are six tasks to elaborate: to elaborate the workshop drawing of different
machine elements and components. Endurance technical definitions. Contact among
machine elements.Elements for energy process in machine systems. Elements for material
flow in machine systems: pipes, pipe fittings, tanks etc. Structural materials and their
technology in chemical industry. Structure of non-ferrous metals. Iron-carbon double
phased systems, crystallization and metamorphism. Alloy steel and non-ferrous metals.
Modification of based properties by annealing. Static and metallographic investigation of
welded bound by smelting processes. Destruction tests and non-destruction tests of welded

Compulsory/Recommended Readings:

29. MECHANICS FOR CHEMICAL ENGINEERS II.

Code: MFVGE32V03
Classes/week: 2 hours of lecture and 1 hour of follow up seminar
ECTS Credit Points: 3
Prerequisites: MFVGE31V03
Lecturer: Horváth, Róbert


Compulsory/Recommended Readings:

30. MECHANICS FOR CHEMICAL ENGINEERS III.

Code: MFVGE33V04
Classes/week: 2 hours of lecture and 2 hours of follow up seminars
ECTS Credit Points: 4
Prerequisites: MFVGE32V03
Lecturer: Horváth, Róbert


Compulsory/Recommended Readings:

31. UNIT OPERATIONS I.

Code: MFVMU31V05
Classes/week: 2 hours of lectures, 4 hours of seminars
ECTS Credit Points: 5
Prerequisites: TFBE2113
Lecturer: Gulyás, Lajos

Flow of fluids, energy and momentum relationships. Pumping of fluids. Pumps, compressors and vacuum pumps.
Separation of heterogeneous systems: Sedimentation, filtration, centrifugation, mixing of liquid, gas cleaning.

Compulsory/Recommended Readings:

32. UNIT OPERATIONS II.

Code: MFVMU32V05
Classes/week: 2 hours of lectures, 4 hours of seminars
ECTS Credit Points: 5
Prerequisites: MFVMU31V05
Lecturer: Gulyás, Lajos

**Compulsory/Recommended Readings:**

**33. UNIT OPERATIONS III.**

**Code:** MFVMU33V05  
**Classes/week:** 2 hours of lectures, 4 hours of seminars  
**ECTS Credit Points:** 5  
**Prerequisites:** MFVMU32V05  
**Lecturer:** Gulyás, Lajos


**Compulsory/Recommended Readings:**
34. COMPUTER MODELLING OF CHEMICAL TECHNOLOGY SYSTEMS I.

Code: TKBG0912
Classes/week: 3 hours of seminars
ECTS Credit Points: 3
Prerequisites: TKBG0911
Lecturer: Kuki, Ákos

Topics: Chemcad is a chemical process simulation software which enables the drawing of flow charts and the simulation of industrial processes. The aim of the course is that chemical engineer students acquire the knowledge of using the Chemcad software package. They will have the opportunity to model technologies known from their previous studies as well as planning new processes. Through using the software they can broaden their knowledge in the field of industrial devices and processes, besides they can learn novel, up to date industrial and environmental technologies. By the end of the semester the skilled application of the software is required which will be tested by a practical exam including the construction of a complex industrial process.

Compulsory/Recommended Readings:

35. COMPUTER MODELLING OF CHEMICAL TECHNOLOGY SYSTEMS II.

Code: TKBG0913
Classes/week: 3 hours of seminars
ECTS Credit Points: 3
Prerequisites: TKBG0912
Lecturer: Kuki, Ákos

Course Description:

Compulsory/Recommended Readings:

36. CHEMICAL TECHNOLOGY I.

Code: TKBE1111 and TKBL1111
Classes/week: 2 hours of lecture, 2 hours of seminar and 5 hours of laboratory work
ECTS Credit Points: 8
Prerequisites: MFVGE31V03
Lecturer: Zsuga, Miklós


Topics of the seminar: Exploration of the terms, laws of lecture topics. Problem solving and calculations based on technologies. Overview of flowcharts and processes.

Topics of the laboratory work:

Compulsory/Recommended Readings:
2. Muhlynov I.: Chemical Technology I-II.

37. CHEMICAL TECHNOLOGY II.

Code: TKBE1112 and TKBL1112
Classes/week: 2 hours of lecture, 2 hours of seminar and 5 hours of laboratory work
ECTS Credit Points: 8
Prerequisites: TKBE1111 and TKBL1111
Lecturer: Zsuga, Miklós

Topics

Compulsory/Recommended Readings:
2. Muhlynov I.: Chemical Technology I-II.
38. ENVIRONMENTAL TECHNOLOGY

Code: TKBE1114 and TKBL1114
Classes/week: 2 hours of lecture, 2 hours of seminar and 2 hours of laboratory work
ECTS Credit Points: 6
Prerequisites: TKBE1112 and TKBL1112
Lecturer: Deák, György


Compulsory/Recommended Readings:
2. Muhlynov I.: Chemical Technology I-II.

39. PILOT PLANT WORK

Code: TKBL1115
Classes/week: 1 hour of problem-solving seminar and 5 hours of pilot plant work
ECTS Credit Points: 4
Prerequisites: Chemical technology I. (TKBE1111)
Lecturer: Nagy, Miklós


Compulsory/Recommended Readings:
2. Muhlynov I.: Chemical Technology I-II.

40. SAFETY

Code: TKBE0711
Classes/week: 2 hours of lecture
ECTS Credit Points: 3
Prerequisites: TKBE1112
Lecturer: Deák, György; Nagy József
Topics:
Basic definitions. Safety in a workplace, legal and organization issues. Accident-free work
and safety. Health-protection at workplaces, working conditions. Influence of
Environmental effects and the personality on safety at work. Safety issues of handtools,
machinery and electricity. Chemical safety and safety in the chemical industry. Man
protection tools. Fire protection: definition of, appliances of and the rules in case of a fire,
legal issues. Rules and safety measures in a chemical laboratory.

Compulsory/Recommended Readings:

41. BASICS OF PETROCHEMISTRY

Code: TKBE1113
Classes/week: 2 hours of lecture
ECTS Credit Points: 3
Prerequisites: TKBE1111
Lecturer: Nemes, Sándor

Topics: Primary raw materials for petrochemicals: crude oils and natural gas; hydrocarbon
intermediates: paraffinic hydrocarbons, olefinic hydrocarbons, aromatic hydrocarbons;
processing and production of hydrocarbon intermediates: methane, ethane, propane,
butanes, ethylene, propylene, butylenes, butadiene, isoprene, benzene, toluene, xylenes;
physical separation processes (distillation, absorption, adsorption, extraction); conversion
processes (cracking, catalytic cracking, hyrocracking, catalytic reforming, pyrolysis);
process and product schemes; uses of synthesis gas; syntheses involving carbon monoxide.

Recommended Readings:

42. RADIOISOTOPES

Code: TKBG0412
Classes/week: 1 hour of lecture and two hours of laboratory practice
ECTS Credit Points: 3
Prerequisites: TKBE0512
Lecturer: M. Nagy, Noémi

Topics of the practice: One of the following:
- Characteristics of a GM-tube
- Liquid scintillation technic
- Self adsorption of beta rays
Two of the following:
- Thickness measurement using beta-rays
- Radioactive volumetry
- Radiometric titration
- Gamma spectroscopy
- Solubility measurement of a salt

Compulsory/Recommended Readings:

43. WASTE MANAGEMENT

Code: TKBE1116 and TKBL1116
Classes/week: 2 hours of lecture, 4 hours of seminars
ECTS Credit Points: 3+3
Prerequisites: TKBE1112, TKBL1112
Lecturer: Bodnár, Ildikó and Deák, György

Topics: Its aim is to educate and prepare waste management professionals for the challenges facing the industry and environment. Waste management is the collection, transport, processing, recycling or disposal of waste materials. Waste management is also carried out to reduce the materials' effect on the environment and to recover resources from them. Grouping of wastes (solid, liquid or gaseous substances), and application of different methods for their handling. Waste management practices differ for developed and developing nations, for urban and rural areas, and for residential and industrial, producers. Utilization of wastes. Plastic wastes. Importance and application biodegradable polymers/plastics. Natural and synthetic biodegradable polymers/plastics. Biodegradation. Environmental importance of these materials.

Compulsory/Recommended Readings:


44. **SPECTROSCOPY**

**Code: TKBE0503**  
Classes/week: 1 hour of lecture and 1 hour of problem solving seminar  
ECTS Credit Points: 3  
Prerequisites: TKBE0312, TKBL0312  
Lecturer: Kurtán, Tibor; Szilágyi, László; Kiss, Attila


Compulsory/Recommended Readings:  

45. **STRUCTURE OF MATTER I.**

**Code: TKBL0513**  
Classes/week: 2 hours of laboratory practice  
ECTS Credit Points: 1  
Prerequisites: TKBE0511, TKBL0511  
Lecturer: Kéki, Sándor

Topics: UV-VIS photometry: Basics of UV-VIS photometry. Recording and evaluation of UV-VIS spectra obtained on aqueous solutions of ferroin and KMNO$_4$. Investigation of the validity of Lambert-Beer’s law for aqueous solutions of ferroin: calibration, determination of the concentrations of ferroin solutions. Determinations of the component concentrations...

Compulsory/Recommended Readings:

46. STRUCTURE OF MATTER II.

Code: TKBL0514
Classes/week: 4 hours of laboratory practice
ECTS Credit Points: 2
Prerequisites: TKBL0513
Lecturer: Kéki, Sándor

Topics: Mass Spectrometry I. MALDI-TOF MS: Recording of MALDI-TOF mass spectra of poly(ethylene glycol), poly(propylene glycol), polystyrene and poly(nethyl methacrylate). Determinations of the mass of the repeat units and the end-groups. ESI-MS: Recording of ESI mass spectra of low (e.g. plasticizers) and high molecular weight (e.g. cytochrom C, poly(ethylene glycol)) compounds. Evaluation of the obtained mass spectra. Comparison of the measured and calculated masses. Determinations of mass resolution and accuracy. Calculation of molecular mass for multiply charged species. Liquid chromatography: Recording of HPLC-UV traces for different plasticizers (e.g. DOP, DUP, TOTM). Calibrations. Qualitative and quantitative determinations of plasticizers. Size exclusion chromatography (SEC): Recording of SEC traces of poly(ethylene glycol), poly(propylene glycol), polystyrene and polyisobutylene. Determinations of number-average \( (M_n) \), weight average molecular weight and polydispersity of these samples.

Compulsory/Recommended Readings:
47. QUALITY MANAGEMENT

Code: TKBE0711
Classes/week: 2 hours of lecture and 1 hour of problem solving seminar
ECTS Credit Points: 3
Prerequisites: MFSZE31X03
Lecturer: Varga Emilné Szűcs, Edit


Compulsory/Recommended Readings:

48. DESIGN OF EXPERIMENTS

Code: MFVK31X03
Classes/week: 2 hours of lecture
ECTS Credit Points: 3
Prerequisites: MFVMU33V05
Lecturer: Gulyás, Lajos


Compulsory/Recommended Readings:
1. J. P. Adler, E. V. Markov, J. V. Granovszkij: The design of experiments, determination of optimal conditions.. Moszkva (1977)
49. BSc Thesis

Code: TKBG2011
Classes/week: 15 hours of engineering, or laboratory work
ECTS Credit Points: 15
Prerequisites: at least 180 credits
Lecturer: Zsuga, Miklós; individually assigned supervisors

Topics: Individual engineering or laboratory research at selected industrial companies, or one of the research groups of the Chemistry Institute with the guidance of a supervisor. Students are expected to carry out novel work and write a 20-40 page B.Sc. thesis as a result.

Compulsory/Recommended Readings:
Assigned by the supervisors depending on the individual research projects.

50. CHEMICAL TECHNOLOGY III.

Code: TKBE1117
Classes/week: 2 hours of lecture
ECTS Credit Points: 3
Prerequisites: TKBE1112
Lecturer: Zsuga, Miklós

Topics: Silicate industry: processes and products of glass, ceramics and enamell. Micromiological industries: types, conditions and products of fermentation. Production of yeast, ethanol, vinegar, antibiotics and beer. Production of sugar and vegetable-oil, usage of byproducts.

Compulsory/Recommended Readings:
2. Muhlyonov I.: Chemical Technology I-II.

51. MODELING OF CHEMICAL REACTORS

Code: MFVRE 31V03
Classes/week: 2 hours of lectures
ECTS Credit Points: 3
Prerequisites: MFVMU32V05
Lecturer: Gulyás, Lajos

Course Description:

References:

52. PLASTICS AND PROCESSING II.

Code: TKBE1213
Classes/week: 1 hour of lecture
ECTS Credit Points: 2
Prerequisites: Macromolecular chemistry (TKBE0611)
Lecturer: Deák, György


Compulsory/Recommended Readings:

53. PLASTICS AND PROCESSING III.

Code: TKBE1214
Classes/week: 2 hours of lecture
ECTS Credit Points: 3
Prerequisites: TKBE1213
Lecturer: Deák, György

Compulsory/Recommended Readings:

54. VISITS AT CHEMICAL COMPANIES

Code: TKBX0608
Classes: 5 full days in semester 4
ECTS Credit Points: 0
Prerequisites: TKBE1111 and TKBL1111
Lecturer: Nemes, Sándor (organizer)

Topics: Participating chemical companies (all within 150 km from the campus of the University of Debrecen): Biogal-Teva Rt., AKSD Rt., Tiszai Végyi Kombinát Rt., TAURUS AGROTYRE LTD, BorsodChem Rt., Kabai Cukorgyár Rt., Borsodi Sörgyár Rt., Pannoncem Cementipari Rt., MOL Rt. Tiszai Finomító, AGROFERM Rt., UNILEVER Rt., Tiszamenti Vízművek Rt., Rubbermaid Kft., Helioplast Kft., Eurofoam Kft.

Compulsory/Recommended Readings: none

55. INDUSTRIAL PLACEMENT

Code: TKBX0607
Classes: 4 weeks of practice in the summer after semester 6
ECTS Credit Points: 0
Prerequisites: TKBE1111 and TKBL1111
Lecturer: Nemes, Sándor (organizer)

Topics: Industrial placement is an ideal opportunity to apply existing skills and to develop new ones whilst getting a practical insight into working life in chemical industry, it gives real world experience, and a possible step in a career and provides with the opportunities for the future. All these experiences greatly enhance career prospects for when students graduate.

Industrial placement is an extraordinary opportunity to train and develop personal abilities with competent professionals and gain first hand experience of chemical industry and is an ideal grounding for a future career in chemical industry. It provides integrated industrial and professional training in an area such as operation of a chemical plant and a chance to sharpen skills and acquire work experience.

Compulsory/Recommended Readings: Individually assigned by the host company and/or industrial tutor.
3. The institutional conditions of fulfilling the foreign language requirements stated in the training and graduation manual. For acquiring a BSc diploma candidates must obtain at least an oral or written intermediate level state language certificate or an equivalent language certificate

4. Thesis and Final Exam

Students of the major receive an absolutorium after they satisfied every aspect of their educational and examinational requirements. Students have to write a diploma work after the 6th semester. Writing this is the precondition of the entrance to the final exam. The diploma work will be graded by the final exam committee. In case the diploma work is not accepted he/she cannot carry on with the exam. The final exam is the essential for anyone who wants to get a chemical engineer BSc diploma. The final exam must be taken in front of the final exam committee.

Subjects of the Final Exam:

a. Physical Chemistry
b. Chemical Technology
c. Unit Operation

Requirements of the diploma work

The diploma work is the solution of a chemical engineering task which the student should solve relying on previous studies and secondary literature under the guidance of a tutor in one semester. The diploma work must prove that the author can apply the acquired theoretical knowledge.

The student can choose any topic for a diploma work suggested by the faculty or in occasional cases individual topics acknowledged by the head of the department. Only those tasks can be given as diploma work that can be accomplished within the allotted time limit relying on the skills acquired during the years of study. The topics of the diploma work should be given in completely uniform manner and based on the system of requirements set up by the head of the institute and the head of the department responsible for the specialization. Students must be informed of the diploma topics in the first academic week of the first semester the latest. The diploma works are written with the close collaboration of the candidate and the tutor.

The formal requirements of the diploma work are detailed in the “manual for writing diploma works” which is handed out to every candidate when they decide upon their topic. The diploma works must be handed in to the department responsible minimum ten days before the beginning of the final exam period. The thesis paper is evaluated by an external graduate professional who gives a grade as well as a short written comment on it. The head of the department makes a proposal for the final evaluation of the diploma work based on the comments. The diploma work receives a grade from the final exam committee.