SYLLABUS

1. Information regarding the programme

1.1 Higher education institution	**Babeş-Bolyai University of Cluj-Napoca**
1.2 Faculty	**Environmental Science and Engineering**
1.3 Department	**Environmental Analysis and Assessment**
1.4 Field of study	**Environmental Engineering**
1.5 Study cycle	**Bachelor**
1.6 Study programme / Qualification	**Environmental Engineering**

2. Information regarding the discipline

2.1 Name of the discipline	Analysis of industrial processes						
2.2 Course coordinator	Assoc. Prof. Dr. Ing. Török Zoltán						
2.3 Seminar coordinator	Assoc. Prof. Dr. Ing. Török Zoltán						
2.4 Year of study	**III**	2.5 Semester	**V**	2.6. Type of assessment	**C**	2.7 Discipline regime	**Optional.**

3. Total estimated time (hours per semester of didactic activities)

3.1 Hours per week	4	Of which: 3.2 course	2	3.3 Seminar/laboratory	2
3.4 Total hours in the curriculum	56	Of which: 3.5 course	28	3.6 Seminar/Laboratory	28
Time allotment:					Hours
Learning using manual, course support, bibliography, course notes					20
Additional documentation (in libraries, on electronic platforms, field documentation)					20
Preparation for seminars/labs, homework, papers, portfolios and essays					28
Tutorship					0
Evaluations					2
Other activities:					

3.7 Total individual study hours	**70**
3.8 Total hours per semester	**126**
3.9 Number of ECTS credits	**5**

4. Prerequisites (if necessary)

4.1 Curriculum	• knowledge of the fundamental elements of environmental science and engineering: chemistry, mathematics, physics, unit operations
4.2 Competences	• Technical;

5. Conditions (if necessary)

5.1 For the course	• requires digital projector and laptop
5.2 for the seminar/lab activities	• access to computers for the use of specific programs (ChemCAD)

6. Specific competences accumulated

Professional competences	• Ability to solve balance problems associated with industrial processes; • The ability to use the learned notions to establish the structure of an industrial process and technological flow; • Ability to understand and interpret technology drawings, such as: site plans, flow charts, piping and instrumentation diagrams (P&ID), etc.
Transversal competences	• Execution of the requested tasks according to the specified requirements and within the imposed deadlines, in compliance with the norms of professional ethics and moral conduct, following a pre-established work plan • Solving the requested tasks in accordance with the general objectives established by integration within a working group • Permanent information and documentation in his field of activity in Romanian • Concern for improving the results of the professional activity by involvement in the activities carried out.

7. Objectives of the discipline (resulting from the grid of accumulated skills)

7.1 General objective of the discipline	• To familiarize students with the basics, concepts, theories and basic models in the field of process and chemical and environmental engineering.
7.2 Specific objectives	• Acquisition of basic theoretical knowledge for the analysis and synthesis of industrial processes • Acquisition of knowledge regarding the preparation of mass and energy balances • Acquisition of knowledge regarding the interpretation of technological drawings, such as: site plans, flow charts, piping and instrumentation diagrams (P&ID) etc.

8. Contents

8.1 Course	Teaching methods	Remarks
1. Introductory notions. System, technological process, production process, technological flow, technological line equipment, characteristic parameters, technological regime, reaction mass, reaction mixture, limiting reactant, excess, recirculation ratio, spatial velocity, contact time, conversion, selectivity, efficiency, technical-economic indicators.	lecture, interactive discussions	
2. Introduction (continued). Reliability, technical symbols and technological schemes, structure of technological systems, classification (continuous-discontinuous, series-parallel, equicurrent-countercurrent, cyclic-acyclic), speed of technological processes.	lecture, interactive discussions	
3. Material balances in technological systems. Presentation, solving techniques, systems without reaction – with reaction, without recirculation – with recirculation, bypass, purge.	lecture, interactive discussions	
4. Thermal balances in technological systems. Presentation, solving techniques, systems without reaction – with reaction.	lecture, interactive discussions	
5. The stages of the synthesis of a technological system. Types of problems synthesis, design, basic chemicals, industrial, consumer, stages.	lecture, interactive discussions	

6. Environmental protection and operational safety issues to be addressed during the synthesis process. Fuel combustion, waste disposal, waste handling, residue minimization, fire and explosion, prevention techniques, safety devices.	lecture, interactive discussions	
7. Design of the technological process (stage 4 of the synthesis). Preparation of the preliminary database, the experiment, the preliminary synthesis, the stages of the preliminary synthesis.	lecture, interactive discussions	
8. Synthesis of the process of obtaining vinyl chloride Elimination of differences between the types of molecules, distribution of substances/currents, elimination of compositional differences, elimination of differences in temperature, pressure, phase, integration.	lecture, interactive discussions	
9. Designing the basic process. Advanced process synthesis (stage 5 and 6 of the synthesis) Design of the detailed technological flow, process integration, preparation of the detailed database, pilot testing, synthesis of networks of reactors, separators, heat exchangers.	lecture, interactive discussions	
10. Heuristic rules applied in the synthesis process. Rules applied to the choice of the chemical reaction, in the stage of distribution of substances, rules applied to separation, to the modification of temperature, pressure.	lecture, interactive discussions	
11. Analysis and synthesis of chemical systems (purpose of developing mathematical models, classification, characterization, types of mathematical models). Analytical model, balance equations, statistical model.	lecture, interactive discussions	
12. Analysis and synthesis of chemical systems . Example – SO2 oxidation; preparation of the analytical model. Process structure, heat balance, mass balance, process stoichiometry, equilibrium, kinetics, kinetic equations, optimal conditions.	lecture, interactive discussions	
13. Recap Course 1.	lecture, interactive discussions	Summary. Recap.
14. Recap Course 2. General conclusions on risk assessment and communication.	lecture, interactive discussions	Summary. Recap. Conclusions. Discussion of the examination.

Bibliography

Course Support:

- The presentations held at the course in PDF format, available at the FSIM library on CD and are sent to students upon request by email.

Books:

1. N. Dulămiţă, M. Stanca, *Chemical Technology*, Cluj University Press, 1999.
2. W. D. Seider, J. D. Seider, D. R. Lewin, *Product and Process Design Principles. Synthesis, Analysis and Evaluation*, John Wiley and Sons Inc., New York, 2003.
3. R. Smith, *Chemical Process: Design and Integration*, John Wiley and Sons Inc., New York, 2005.
4. D. M. Himmelblau, *Basic Principles and Calculations in Chemical Engineering*, Prentice Hall of India, New Delhi, 1989.
5. J. M. Douglas, *Conceptual Design of Chemical Processes*, McGraw-Hill, New York, 1988.

6. A. I. Lucaci, P. Ş. Agachi, *Optimizing Processes in the Chemical Industry*, Technical Publishing House, Bucharest, 2002.
7. N. Dulămiţă, M. Stanca, F. Irimie, F. Buciuman, *Practical Works on General Chemical Technology*, lithographed, Babeş-Bolyai University of Cluj-Napoca, 1994.

Access places: Central University Library, Library of the Faculty of Environmental Science and Engineering.
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8.2 Seminar / **laboratory**	Teaching methods	Remarks
1. Presentation of the approached theme. Requirements. Introductory notions.	-lecture; -conversation; -explanation.	2 hours
2. Technical-economic indicators. Conversion, selectivity, yield, specific consumption, productivity. Problem solving.	-lecture; - problematization; -conversation; -explanation.	4 hours
3. Functional symbols.	-lecture; - problematization; -conversation; -explanation.	4 hours
4. Technological schemes; Types and preparation (examples) Preparation of the balance of materials for the extraction-distillation technological process.	-lecture; - problematization; -conversation; -explanation.	4 hours
5. Problem solving - material balance I (no chemical reaction, recirculation);	-lecture; - problematization; -conversation; -explanation.	6 hours
6. Problem solving - material balance II (by-pass, purge, chemical reaction);	-lecture; - problematization; -conversation; -explanation.	6 hours
7. Evaluation.		2 hours

Bibliography

1. N. Dulămiţă, M. Stanca, *Chemical Technology*, Cluj University Press, 1999.
2. W. D. Seider, J. D. Seider, D. R. Lewin, *Product and Process Design Principles. Synthesis, Analysis and Evaluation*, John Wiley and Sons Inc., New York, 2003.
3. R. Smith, *Chemical Process: Design and Integration*, John Wiley and Sons Inc., New York, 2005.
4. D. M. Himmelblau, *Basic Principles and Calculations in Chemical Engineering*, Prentice Hall of India, New Delhi, 1989.
5. J. M. Douglas, *Conceptual Design of Chemical Processes*, McGraw-Hill, New York, 1988.
6. A. I. Lucaci, P. Ş. Agachi, *Optimizing Processes in the Chemical Industry*, Technical Publishing House, Bucharest, 2002.
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9. Corroborating the content of the discipline with the expectations of the epistemic community, professional associations and representative employers within the field of the program

By acquiring the theoretical-methodological concepts and approaching the practical aspects included in the discipline Analysis and Synthesis of Industrial Processes, students acquire a consistent knowledge baggage, in accordance with the partial skills required for the possible occupations provided in Grid 1 – RNCIS.

10. Evaluation

Type of activity	**10.1 Evaluation criteria**	**10.2 Evaluation methods**	**10.3** Share in the grade (%)
Seminar/ laboratory	*Each student is evaluated individually according to the following criteria:* - Correctness of answers – the correct acquisition and understanding of the issues dealt with at the seminar. - Active participation in solving seminar problems.		20 %
Course	• correctness of solving theoretical and practical problems during the exam	Final exam (written – 2 hours) – access to the exam is conditioned by attendance at least 80% of the seminar sessions. The intention of fraud in the exam is punishable by elimination from the exam. Exam fraud is punishable by expulsion according to the ECST regulation of the BBU	80%
Minimum performance standard: • grade 5 from the seminar and grade 5 from the written exam • Attendance at least 80% at seminar/laboratory classes.			

Date Signature of the course coordinator Signature of the seminar coordinator

05.12.2024.....

Date of approval in the department Signature of the department director

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