UNIVERSITATEA BABEŞ-BOLYAI
BABEŞ-BOLYAI TUDOMÁNYEGYETEM
BABEŞ-BOLYAI UNIVERSITÄT
BABEŞ-BOLYAI UNIVERSITY
TRADITIO ET EXCELLENTIA

Tradiție și Excelență prin
Cultură - Știință - Inovație din 1581

Facultatea de Chimie și Inginerie Chimică

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FIŞA DISCIPLINEI

Transfer Process intensification

University year 2025-2026

1. Date despre program

1.1. Higher education institution	Babes-Bolyai University
1.2. Faculty	Faculty of Chemistry and Chemical Engineering
1.3. Department	Chemical Engineering
1.4. Field of study	Chemical engineering
1.5. Study cycle	Master
1.6. Study programme/Qualification	Advanced Chemical Process Engineering
1.7. Form of education	Full-time education

2. Date despre disciplină

2.1. Name of discipline	**Transfer process Intensification**					Discipline Code	**CME7323**
2.2. Course coordinator	Conf. Dr. Ing. Letiția Petrescu						
2.3. Seminar coordinator	Conf. Dr. Ing. Letiția Petrescu						
2.4. Year of study	I	2.5. Semester	2	2.6. Type of evaluation	E	2.7. Discipline regime	DF/ Compulsory

3. Timpul total estimat (ore pe semestru al activităților didactice)

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/laborator	28
Time allotment for individual study (ID) and self-study activities (SA)					**hours**
Learning using manual, course support, bibliography, course notes (SA)					20
Additional documentation (in libraries, on electronic platforms, field documentation)					16
Preparation for seminars/labs, homework, papers, portfolios and essays					20
Tutorship					10
Evaluations					3
Other activities:					-
3.7. Total individual study hours	69				
3.8. Total hours per semester	125				
3.9. Number of ECTS credits	5				

4. Prerequisites (if necessary)

4.1. curriculum	Not applicable
4.2. competencies	Not applicable

5. Conditions (if necessary)

5.1. for the course	• Regular attendance is encouraged. Classes will start on time, according to the official schedule.

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	• Absences: Whenever possible, unavoidable absences should be discussed with the course responsible (in person or via e-mail) before the course to take place. If you miss the exam, if you are late handing a theme or project due to an unforeseen event or a reason recognized by the university, contact the course coordinator prior to the event (if possible) to find a solution to this problem. • You are responsible for obtaining the information presented in courses which are not common. • As a classroom building policy, is not permitted to eat in the classroom. Smoking is also prohibited. Students are encouraged to shut down cell phones or other electronic communication devices (i.e., chat software) throughout the course. It is not allowed to use e-mail or web-browsing during class hours. • Any disruptive behaviour will be punished accordingly. • No part of the course (printed and online materials, lectures, workshops, discussion sessions, etc.) can be recorded (audio or video), broadcast or re-published without the written consent of the course responsible. • Special Needs: All reasonable efforts will be made to meet individual student needs. If there is a learning disability or other, students are asked to seek an audience with the course responsible to discuss their needs. Also, international students (or otherwise not speaking English) are encouraged to contact the course responsible if they need help to overcome the "language barrier". All discussions will be kept strictly confidential. • Academic Honesty: This policy can be found in the University Charter and covers plagiarism, cheating, fabrication, and facilitating dishonesty. Events in any of these practices will be dealt with according to university policy. • Exam Fraud is punishable by expulsion as mentioned in the University Charter. • Grievance procedure: If you feel that a note given is incorrect for any reason, you can challenge it by filing a written explanation with the material noted for instructor within one week of receiving the grade.
5.2. for the seminar /lab activities	• This seminar / lab is mandatory. • It is essential that students possess strong computer skills to use. • Special Needs: All reasonable efforts will be made to meet individual student needs. If there is a learning disability or other, students are asked to seek an audience with the course responsible to discuss their needs. Also, international students (or otherwise better not speaking English) are

	encouraged to contact the course responsible if they need help to overcome the "language barrier". All discussions will be kept strictly confidential. • Presentation of seminar assignments and projects is mandatory. • Special Needs: All reasonable efforts will be made to meet individual student needs. If there is a learning disability or other, students are asked to seek an audience with the course responsible to discuss their needs. Also, international students (or otherwise not speaking English) are encouraged to contact the course responsible if they need help to overcome the "language barrier". All discussions will be kept strictly confidential. • As a building policy for seminar halls, in classrooms eating is not permitted. Smoking is also prohibited. Students are encouraged to shut down cell phones or other electronic communication devices (e.g. chat software) during the seminar. It is not allowed to use e-mail or web-browsing during seminar hours. • Academic Honesty: This policy can be found in the University Charter and covers plagiarism, cheating, fabrication, and facilitating dishonesty. Events in any of these practices will be dealt with according to university policy. • Assignments and projects must be completed individually by each student.

6.1. Specific competencies acquired [1]

Professional/essential competencies	• Define concepts, theories and models in chemistry and advanced chemical engineering process and their appropriate use in professional communication. • Use extensive knowledge of chemistry and chemical engineering process for explanation and interpretation of chemical processes. • Identify and apply the concepts, methods and advanced theories to solve new complex chemical process engineering. • Critical analysis and use of principles, methods and advanced techniques for quantitative and qualitative evaluation of chemical engineering processes. • Application of advanced concepts and theories of chemical process engineering for process drafting and problem solving. • Use advanced concepts of analysis and process synthesis, machines and specific equipment of process engineering. • Use in a creative manner expertise, methods and concepts for analysis and synthesis of new chemical processes. .

[1] One can choose either competences or learning outcomes, or both. If only one option is chosen, the row related to the other option will be deleted, and the kept one will be numbered 6.

	• Use integrated analysis and synthesis of chemical processes to develop processes and to obtain innovative products. • Application of modern means of evaluation of new systems performance and improvement of the decisional act in the synthesis of processes. • Creative use of analysis and synthesis in developing product / technology innovation
Transversal competencies	• Independence in execution of complex professional duties and conduct independent research and design activities using computer-assisted techniques and respecting the rules of professional ethics and moral conduct. • Planning, monitoring and taking professional duties of a professional group reports. Demonstrate the ability to coordinate the work, analytical thinking, adaptability and flexibility, collaboration with team members. • Self-assessment of their professional performance and determining training needs, information and documentation in its constant activity and related fields, in line with labor market needs.

6.2. Learning outcomes

Knowledge	• The student knows how to represent chemical/biochemical processes using various types of diagrams; • The student knows the operation of the main machines for impulse transfer, thermal transfer, mass transfer; • The student knows the necessary steps to carry out a chemical/biochemical process; • The student knows how to parameterize the main equipments for momentum transfer, heat transfer, mass transfer; • The student knows the main equipments used to intensify chemical processes.
Skills	• The student is able to realize, using the CHEMCAD program, a simulation of a chemical/biochemical/energy generation process; • The student is able to parameterize traditional and intensification equipments using the CHEMCAD process simulator • The student is able to perform several variants/design alternatives of the same process; • The student is able to compare and interpret the results obtained after the simulation.
Responsibility and autonomy:	• The student has the ability to work independently by completing the exercises/applications presented in the course/seminar. • The student has the ability to compare and intrepret the results obtained from the simulations by comparing them with experimental data/data from the scientific literature.

7. Obiectivele disciplinei (reieșind din grila competențelor acumulate)

7.1 General objective of the discipline	• The course aims to communicate the principles of Process Intensification, whilst providing recommendations for process design and implementation, enabling students to apply these principles and recommendations to their PI processes/problems, and discuss specifications for the selection and operation of PI equipment from an independent standpoint.

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7.2 Specific objective of the discipline	• To provide an understanding of the concept of Process Intensification • To provide knowledge and understanding of application of intensification techniques to a range of processes e.g. heat, mass, momentum transfer, separation processes • To provide an understanding of basic operating principles of a variety of intensified process equipment such as spinning disc reactor, rotary packed beds, compact heat exchangers and micro-reactors etc. • To introduce the PI methodology and the 'tool kits' of laboratory and process plant knowledge specific for PI implementation. Students would see how problems can be solved with a range of different equipment types from the traditional to those intensified • To discuss cases of how PI has been applied and what was gained from the process are presented.

8. Content

8.1 Course	Teaching methods	Remarks
8.1.1. Basic concepts, key words: A bit of history, Process intensification (PI) context, PI definitions, PI facets, PI characteristics Process System Engineering, Process Integration, Process Intensification (definition, comparison, scale, advantages, challenges, disadvantages)	Explanation, Conversation, Description, Problematization	
8.1.2. Basic concepts, key words: PI principles, classification, benefits, tools problem statement, challenges, potential problems	Explanation, Conversation, Description, Problematization	
8.1.3. Basic concepts, key words: Intensification of transport processes (mass, heat, momentum), Process intensification equipment.	Explanation, Conversation, Description, Problematization	
8.1.4. Basic concepts, key words: Process intensification methods: general overview, novel processing methods (multifunctional reactors, hybrid separation)	Explanation, Conversation, Description, Problematization	
8.1.5. Basic concepts, key words: Process intensification methods: use of alternative energy sources (centrifugal field, ultrasound, microwaves, solar energy, electric field, plasma technology) other methods	Explanation, Conversation, Description, Problematization	
8.1.6. Basic concepts, key words: Microreactors (general aspects, comparison with traditional reactors (batch, CSTR), advantages, disadvantages, classification, fabrication, construction materials, applications)	Explanation, Conversation, Description, Problematization	
8.1.7. Basic concepts, key words: Modelling of microreactors (General aspects, Flow Distributions, Heat Transfer, Mass Transfer and Mixing, Hydrodynamic Dispersion, Chemical Kinetics)	Explanation, Conversation, Description, Problematization	
8.1.8. Basic concepts, key words: PI in process separation systems: distillation Plate/tray column configuration	Explanation, Conversation, Description,	

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Packed column configuration (Characteristics, description of PI elements, advantages, disadvantages)	Problematization	
8.1.9. Basic concepts, key words: PI in process separation systems: distillation Multiple effect methods, thermal integration, direct vapor recompression, heat integrated distillation column	Explanation, Conversation, Description, Problematization	
8.1.10. Basic concepts, key words: Reaction-separation systems: reactive distillation (General aspects, classification, benefits, constrains, drawbacks, applications)	Explanation, Conversation, Description, Problematization	
8.1.11. Basic concepts, key words: Reaction-separation systems: Reactive absorption, Membrane separation processes, PI in adsorption	Explanation, Conversation, Description, Problematization	
8.1.12. Basic concepts, key words: Minimization of wastes from chemical processes through Process Intensification and Process Integration	Explanation, Conversation, Description, Problematization	
8.1.13. Basic concepts, key words: Environmental evaluation through Life Cycle Assessment (LCA)	Explanation, Conversation, Description, Problematization	
8.14. Basic concepts, key words: PI in Industrial Practice	Explanation, Conversation, Description, Problematization	

Bibliography

1.Luis Puigjaner, Georges Heyen, (2006) Computer Aided Process and Product Engineering, Hardcover, Wiley-VCH Verlag GmbH, ISBN 3527308040 (3-527-30804-0)
2.Frerich Johannes Keil, (2007) Modeling of Process Intensification, Hardcover, Wiley-VCH Verlag GmbH, ISBN 3527311432
3.David Reay, Colin Ramshaw and Adam Harvey, (2008), Process Intensification Engineering for Efficiency, Sustainability and Flexibility, Elsevier, ISBN 978-0-7506-8941-0 (978-0-080-55808-0)
4.Andrzej Stankiewicz, Jacob A. Moulijn, (2003), Re-engineering the Chemical Processing Plant: Process Intensification (Chemical Industries), CRC Press, ISBN-10: 0824743024 (13: 978-0824743024)
6. Kmelia Boodhoo and Adam Harvey (2013). Process Intensification for green chemistry, Wiley, ISBN 9780470972670
6. Ben-Guang Rong (2017). Process Synthesis and process intensification, De Gruyter, ISBN 978-3-11-046505-1
7. Fernando Israel Gomez-Castro, Juan Gabriel Seovia-Hernandez (2019). Process Intensification, De Gruyter, ISBN 978-3-11-059607-6

8.2 Seminar / laboratory	Teaching methods	Remarks
8.2.1 Basic concepts, key words: Process simulation using CHEMCAD (review of concepts of CHEMCAD usage)	Explanation, Conversation, Description, Problematization	
8.2.2 Basic concepts, key words: process simulation using CHEMCAD (review of concepts of CHEMCAD usage)	Explanation, Conversation, Description, Problematization	
8.2.3 Basic concepts, key words: benzene-toluene separation, CHEMCAD simulation	Explanation, Conversation,	

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	Description, Problematization	
8.2.4 Basic concepts, key words: absorption-desorption process, CHEMCAD simulation	Explanation, Conversation, Description, Problematization	
8.2.5 *Basic concepts, key words:* AGR CHEMCAD simulation	Explanation, Conversation, Description, Problematization	
8.2.6 *Basic concepts, key words:* Azeotropic distillation, CHEMCAD simulation	Explanation, Conversation, Description, Problematization	
8.2.7 *Basic concepts, key words:* Multiple effect method CHEMCAD simulation	Conversation, Description, Problematization	
8.2.8 Basic concepts, key words: VOC removal, CHEMCAD simulation	Conversation, Description, Problematization	
8.2.9 Basic concepts, key words: heat distillation integrated columns	Conversation, Description, Problematization	
8.2.10 Basic concepts, key words: reactive distillation, CHEMCAD application	Conversation, Description, Problematization	
8.2.11 Basic concepts, key words: reactive distillation, CHEMCAD application	Conversation, Description, Problematization	
8.2.12 Basic concepts, key words: extractive distillation, CHEMCAD application	Conversation, Description, Problematization	
8.1.13 Basic concepts, key words: membrane separation, CHEMCAD simulation	Conversation, Description, Problematization	
8.1.14 Basic concepts, key words: waste minimization using PI	Conversation, Description, Problematization	

Bibliography

1.Luis Puigjaner, Georges Heyen, (2006) Computer Aided Process and Product Engineering, Hardcover, Wiley-VCH Verlag GmbH, ISBN 3527308040 (3-527-30804-0)
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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

The acquisition of the theoretical-methodological concepts and the approach of the practical aspects included in the Process Intensification discipline the will students acquire a consistent knowledge bag in accordance with the competencies of the Diploma Supplement and the qualifications of the ANC.

10. Evaluation

Type of activity	10.1 Evaluation criteria	10.2 Evaluation methods	10.3 Share in the grade (%)
10.4 Course	Acquiring and understanding of the course content information	Exam	50%
10.5 Seminar/lab activities	Fairness issues - learning and understanding of issues addressed in the seminar / laboratory	Assignments	50%
10.6 Minimum performance standards			
➢ Understanding of the concept and framework of Process Intensification ➢ Demonstrate knowledge and understanding of application of intensification techniques to a basic range of processes related to heat and mass transfer. ➢ In order to participate to the written exam each student should have submitted the assignments.			

11. Etichete ODD (Obiective de Dezvoltare Durabilă / Sustainable Development Goals)[2]

Date:
17.03.2025

Signature of course coordinator

Signature of seminar coordinator

Date of approval:
14.04.2025

Signature of the head of department

Prof. Eng. Graziella Liana Turdean

[2] Păstrați doar etichetele care, în conformitate cu *Procedura de aplicare a etichetelor ODD în procesul academic*, se potrivesc disciplinei și ștergeți-le pe celelalte, inclusiv eticheta generală pentru *Dezvoltare durabilă* - dacă nu se aplică. Dacă nicio etichetă nu descrie disciplina, ștergeți-le pe toate și scrieți "*Nu se aplică.*".