SYLLABUS

1. Information regarding the programme

1.1 Higher education institution	**University “Babeş-Bolyai” Cluj-Napoca**
1.2 Faculty	**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**

2. Information regarding the discipline

2.1 Name of the discipline			**Process Design using Specific Software – CME7311**				
2.2 Course coordinator			Conf. dr. ing. Imre-Lucaci Árpád				
2.3 Seminar coordinator			Conf. dr. ing. Imre-Lucaci Árpád				
2.4. Year of study	**I**	2.5 Semester	**2**	2.6. Type of evaluation	**E**	2.7 Type of discipline	**Ob**

3. Total estimated time (hours/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	**21**
Additional documentation (in libraries, on electronic platforms, field documentation)	**8**
Preparation for seminars/labs, homework, papers, portfolios and essays	**28**
Tutorship	**6**
Evaluations	**6**
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 necessary
4.2. competencies	• not necessary

5. Conditions (if necessary)

5.1. for the course	• no conditions
5.2. for the seminar/lab activities	• no conditions

6. Specific competencies acquired

Professional competencies	• Defining language and identify advanced concepts of design of processes, equipments and devices in process industries as well as the fundamental tools of computer aided design (CAD) • Use of extensive design knowledge for explanation and interpretation of technological design solutions of processes, equipments and devices in a (bio)chemical system by using CAD tools • Use of extensive knowledge of design to identify potential solutions for complex design problems of devices and equipments in a (bio)chemical system by using CAD tools • Assessment and critical-constructive analysis of processes, devices and equipments based on concepts, theories, models, methods and design practices in order to propose their design solutions • Formulation, development and creative elaboration of design solutions for design of processes, devices and equipments for process industries, integrated design based on CAD tools • Development of dynamic mathematical models with distributed parameters, their implementation in simulators used in the evaluation of the process performance by identifying operational and management solutions with economical benefits, increased energy efficiency, increased operational safety and low environmental impact
Transversal competencies	• Independent execution of complex professional duties and conduct autonomous research and design activities using computer-assisted techniques in compliance with the rules of professional ethics and moral behavior

7. Objectives of the discipline (outcome of the acquired competencies)

7.1 General objective of the discipline	• Introduction in the use of specific software products for design of processes in process industries.
7.2 Specific objective of the discipline	• Ability to design and conduct numerical experiments and to analyze and interpret the data • Ability to identify, formulate and solve engineering problems • Ability to elaborate statistical and analytical, steady state and dynamic mathematical models, to build and use software simulators which represent the behavior of the real chemical system, in concordance with the goal of the investigation of it • Ability to design a system, a component or a process to achieve the necessary conditions • Ability to understand and interpret the evolution in space and time of a chemical system, to abstract and represent it in the form of a mathematical model • Ability to establish interpersonal relations favorable for team work

8. Content

8.1 Course	Teaching methods	Remarks
1. Importance of mathematical modeling and	Lecture. Explanation.	

simulation of the processes in the chemical industry. Process simulators – general presentation.	Conversation. Description.	
2. Process design. Basic principles. Integrated process design.	Lecture. Explanation. Conversation. Description.	
3. Process synthesis by hierarchical approach.	Lecture. Explanation. Conversation. Description.	
4-6. Reaction process synthesis. Separation process synthesis. Residue Curve Maps - RCM. Distillation Region Diagrams - DRD.	Lecture. Explanation. Conversation. Description. Problem solving.	
7-9. Case studies from the chemical industry solved in CHEMCAD. Vinyl acetate process.	Lecture. Explanation. Conversation. Description. Problem solving.	
10-12. Case studies from the chemical industry solved in AspenPlus. Vinyl acetate process. Acrylonitrile process.	Lecture. Explanation. Conversation. Description. Problem solving.	
13-14. Environmental regulations. Methods to reduce the pollution by using appropriate process design solutions. Examples and case studies. Early environmental assessment of processes.	Lecture. Explanation. Conversation. Description. Problem solving.	

Bibliography

1. * * *, *CHEMCAD - User's Manual*, The Chemstations, Houston, U.S.A., 2016
2. * * *, *AspenPlus. Getting Started*, AspenTech Inc., U.S.A., 2014
3. *W.L. Luyben*, Plantwide dynamic simulators in chemical processing and control, Marcel Dekker Inc. Publisher, NY, U.S.A., 2002
4. *Dimian A.C., Bâldea C.S.*, Chemical Process Design. Computer-Aided Case Studies, Wiley-VCH, Germany, 2008

8.2 Seminar / laboratory	Teaching methods	Remarks
1. Process simulators – general presentation.	Explanation. Problem solving. Examples solved by using the computer.	
2. Presentation and usage of CHEMCAD process simulator. Flow through a pipeline network. Cooling water flow rate calculation for chlorine liquefaction process.	Explanation. Problem solving. Examples solved by using the computer.	
3. Presentation and usage of CHEMCAD process simulator. Simulation of reactors. Determination of the heat flow to a isothermally operated reactor. Elements of thermal integration.	Explanation. Problem solving. Examples solved by using the computer.	
4. Presentation and usage of CHEMCAD process simulator. Modeling and simulation of separation processes. Examples.	Explanation. Problem solving. Examples solved by using the computer.	
5. Presentation and usage of CHEMCAD process simulator. Sensitivity and process optimization studies. Examples.	Explanation. Problem solving. Examples solved by using the computer.	
6. Presentation and usage of AspenPlus process simulator. Mixing, handling of fluids (pumps, compressors), heat exchangers.	Explanation. Problem solving. Examples solved by using the computer.	
7. Presentation and usage of AspenPlus process	Explanation. Problem solving.	

simulator. Separators and reactors.Simulation of complex processes with recycling.	Examples solved by using the computer.	
8. Presentation and usage of AspenPlus process simulator. Simulation of complex processes with recirculation.	Explanation. Problem solving. Examples solved by using the computer.	
9. Presentation and usage of CHEMCAD process simulator. Sensitivity and process optimization studies. Examples.	Explanation. Problem solving. Examples solved by using the computer.	
10-13. Case studies from process industries solved by using CHEMCAD and AspenPlus. Vinyl acetate process. Acrylonitrile process.	Explanation. Problem solving. Examples solved by using the computer.	
14. Environmental assessment of processes. Early assessment methods at the design phase of processes. Examples.	Explanation. Problem solving. Examples solved by using the computer.	

Bibliography

1. * * *, *CHEMCAD - User's Manual*, The Chemstations, Houston, U.S.A., 2016
2. * * *, *AspenPlus. Getting Started*, AspenTech Inc., U.S.A., 2014
3. *W.L. Luyben*, Plantwide dynamic simulators in chemical processing and control, Marcel Dekker Inc. Publisher, NY, U.S.A., 2002
4. *Dimian A.C., Bâldea C.S.*, Chemical Process Design. Computer-Aided Case Studies, Wiley-VCH, Germany, 2008
5. *Smith R.M.*, Chemical Process: Design and Integration, JohnWiley&Sons Ltd., England, 2005
6. *Sinnott R.K.*, Chemical Engineering Design, Elsevier Butterworth-H., London, England, 2005
7. *Finlayson B.A.*, Introduction to Chemical Engineering Computing, Wiley-Interscience, U.S.A., 2006
8. *Ray M.S., Johnston D.W.*, Chemical Engineering Design Project. A Case Study Approach, Gordon and Breach Science Publishers, New York, U.S.A., 1989

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

- Students acquire a solid knowledge base by the concepts and theoretical and methodological approach on mainly practical aspects and by using dedicated software in the field, according to partial competences required for occupations listed in Grid 1 - RNCIS.

10. Evaluation

Type of activity	10.1 Evaluation criteria	10.2 Evaluation methods	10.3 Share in the grade (%)
10.4 Course	The correctness of the results for the required evaluations.	Individual Project – Mathematical modeling and simulation of a technological process specified by the examiner. Representation and analysis of obtained results.	75 %
	Representation and proper analysis of the results.		
10.5 Seminar/lab activities	The correctness of answers - learning and understanding of issues presented in the seminar / laboratory activities.	Exercises and homeworks using: ChemCAD and Aspen Plus.	25 %
	Work done at the seminar / laboratory.		

10.6 Minimum performance standards
• Attendance at seminar / laboratory in 90% (maximum 1 absence) • Correct identification of the necessary equipments from the unit library of a process simulator for modeling a complex process.

Date	Signature of course coordinator	Signature of seminar coordinator
02. 26. 2018	....	....

Date of approval	Signature of the head of department
02. 26. 2018	