SYLLABUS

1. Information regarding the programme

1.1 Higher education institution	**Babes-Bolyai University**
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	**ICAP/Msc, PCA/Msc**

2. Information regarding the discipline

2.1 Name of the discipline	**Green Chemistry-Theoretical and Technological Aspects**						
Code	CME 7141						
2.2 Course coordinator	**Assoc prof. . Dr. CRISTEA CASTELIA**						
2.3 Seminar coordinator	Assoc prof. Dr. CRISTEA CASTELIA						
2.4. Year of study	**I**	2.5 Semester	**II**	2.6. Type of evaluation	**C**	2.7 Type of discipline	**DS/Opt.**

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

3.1 Hours per week	4	Of which: 3.2 course	2	3.3 seminar	2
3.4 Total hours in the curriculum	56	Of which: 3.5 course	28	3.6 seminar	28
Time allotment:					hours
Learning using manual, course support, bibliography, course notes					14
Additional documentation (in libraries, on electronic platforms, field documentation)					21
Preparation for seminars/labs, homework, papers, portfolios and essays					28
Tutorship					3
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	• General chemistry
4.2. competencies	• No

5. Conditions (if necessary)

5.1. for the course	• The *on-line* courses are not to be recorded by the students
5.2. for the seminar	• Interactive participation • The *on-line* seminars are not to be recorded by the students

6. Specific competencies acquired

Professional competencies	Mastering the principles of "Green Chemistry" as methodology for achieving sustainability in the chemical industry. Using chemical knowledge for environmentally friendly chemistry. Formulate, develop and apply creative solutions for strategic problems by promoting innovative chemical technologies that reduce or eliminate the use or generation of hazardous substances in the design, manufacture and use of chemical products.
Transversal competencies	Team working and professional task Documentation in foreign languages using the new information and comunication technologies.

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

7.1 General objective of the discipline	• To familiarize the students with the green chemistry concept, with the theoretical and technological aspects of sustainable chemical processes.
7.2 Specific objective of the discipline	• To understand the principles of Green Chemistry concept • Life Cycle Assesment of chemical products • To develop abilities in planning strategies of sustainable development

8. Content

8.1 Course	Teaching methods	Remarks
1. Principles of Green Chemistry, definition and specific concepts	Lecturing PPT presentation	1 course
2. Life cycle assessment of chemical products	Lecturing PPT presentation	1 course
3. Prevention of waste formation in chemical industry (/Reduce/Recycle//Recover)	Lecturing PPT presentation	1 course
4. Atom economy (inherently atom economic reactions)	Lecturing PPT presentation	1 course
5. Risk factors: toxicity of chemical products and intermediates.	Lecturing PPT presentation	1 course
6. Design of safer chemical compounds: biodegradable chemical products	Lecturing PPT presentation	1 course
7. Solvents and auxiliaries in industrial chemical processes.	Lecturing PPT presentation	1 course
8. Catalytical processes in chemical industry.	Lecturing PPT presentation	1 courses
9. Renewable resources for the chemical industry	Lecturing PPT presentation	1 courses
10. Alternative energy sources for chemical processes.	Lecturing PPT presentation	1 courses
11. Analytical methods for real time analysis and pollution control.	Lecturing PPT presentation	1 course
12. Processes intensification; modern industrial equipment for unit operations	Lecturing PPT presentation	1 course
13. Reduce/elimination of hazards in chemical	Lecturing	1 course

industry	PPT presentation	
14. Progress and limitations in the design of chemical processes (case studies)	Lecturing PPT presentation	1 course
Bibliography: PPT presentation 1. P. T. Anastas, J. C. Warner "*Green Chemistry Theory and Practice*" Oxford Univ. Press, 1998. 2. M. Lancaster "*Green Chemistry an introductory text*" Pub. The Royal Society of Chemistry, 2002 3. P. Tundo, A. Perosa, F. Zechinni, *Methods and Reagents for Green Chemistry*" J. Wiley and Sons, 2007. 4. W. M. Nelson, *Green solvents for chemistry: perspectives and practice*, Oxford Univ. Press, 2003. 5. M. Doble, A. K. Kruthiventi *Green Chemistry &Engineering*, Elsevier Sci & Technol. Books, 2007.		
8.2 Seminar	Teaching methods	Remarks
1. Life Cycle Assessment (LCA) of polyethyleneterephthalate (PET bottles)	Collaborating,	1 seminar
2. LCA of detergents for household cleaning	Collaborating	1 seminar
3. LCA of paints and dyes	Collaborating	1 seminar
4. LCA of automobile fuels	Collaborating	1 seminar
5. LCA of polystirene	Collaborating	1 seminar
6. LCA of rubber	Collaborating	1 seminar
7. LCA of refrigerants	Collaborating	1 seminar
8. Application of green chemistry principles in the industrial production of methanol	Collaborating	1 seminar
9. Application of green chemistry principles in the industrial production of phenol.	Collaborating	1 seminar
10. Application of green chemistry principles in the industrial production of sulphuric acid	Collaborating	1 seminar
11. Application of green chemistry principles in the industrial production of aniline.	Collaborating	1 seminar
12. Application of green chemistry principles in the industrial production synthetic fibers Nylon.	Collaborating	1 seminar
13. Application of green chemistry principles in the industrial production of plastic materials Polycarbonate.	Collaborating	1 seminar
14. Application of green chemistry principles in the industrial production of acetic acid.	Collaborating	1 seminar

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 content of this discipline is based on a modern/critical approach of chemical processes employed in the design and fabrication of chemical compounds. It is helpful for employers from the chemical industry equally for production and sales programmes.
- The content of this discipline is also valuable for the development of a scientific carrier (doctorate, research)

10. Evaluation

Type of activity	10.1 Evaluation criteria	10.2 Evaluation methods	10.3 Share in the grade (%)
10.4 Course	Demonstrating knowledge of the 12 principles of green chemistry Demonstrating ability to use the green chemistry concepts in the	Exam Written report describing the LCA of a commodity chemical	50%

	analysis of industrial processes for production of commodity chemicals Formulate creative solutions for sustainable development of chemical processes	Oral presentation with ppt support of the LCA Answer to questions addressed by the course coordinator	20% 20%
10.5 Seminar/	Demonstrating understanding of the green chemistry principles	Homework reports	10%
	Demonstrating capacity of adequate use of green chemistry concepts and methods	Homework reports	
10.6 Minimum performance standards			
Demonstrating knowledge of the 12 principles of green chemistry			

Date | Signature of course coordinator | Signature of seminar coordinator

12.04.2021

Date,
Approval in Department

May 07, 2021

Signature,
Head of Chemistry Department

Acad. Cristian Silvestru