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

Str. Arany János nr. 11
Cluj-Napoca, cod poștal 400028
Tel.: 0264-59.38.33
Fax: 0264-59.08.18

secretariat.chem@ubbcluj.ro
www.chem.ubbcluj.ro

SYLLABUS

Assessment of risk, safety, and security factors

University year 2025-2026

1. Information regarding the programme

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

2. Information regarding the discipline

2.1. Name of the discipline	**Risk Factors Assessment, Safety and security**					Discipline code	**CME7321**
2.2. Course coordinator	Assoc. Prof. dr. eng. Alexandra Ana CSAVDARI						
2.3. Seminar coordinator	Assoc. Prof. dr. eng. Alexandra Ana CSAVDARI						
2.4. Year of study	2	2.5. Semester	3	2.6. Type of evaluation	E	2.7. Discipline regime	DF/Compulsory

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	**1/1**
3.4. Total hours in the curriculum	56	of which: 3.5 course	28	3.6 seminar/laborator	14/14
Time allotment for individual study (ID) and self-study activities (SA)					**hours**
Learning using manual, course support, bibliography, course notes (SA)					7
Additional documentation (in libraries, on electronic platforms, field documentation)					28
Preparation for seminars/labs, homework, papers, portfolios and essays					28
Tutorship					4
Evaluations					2
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 the case
4.2. competencies	Not the case Graduation form (Chemical) Engineering programs is an advantage.

5. Conditions (if necessary)

5.1. for the course	• Students will punctually join the class. • Students will follow the sanitary regulations in place.

Str. Arany János nr. 11
Cluj-Napoca, cod poștal 400028
Tel.: 0264-59.38.33
Fax: 0264-59.08.18

secretariat.chem@ubbcluj.ro
www.chem.ubbcluj.ro

	• Rules of good practice will be explained by the lecturer at the beginning of the semester and will be followed accordingly by all participants to the class. • During class, students will keep their mobile phones and any other gadgets on silent mode and out of sight.
5.2. for the seminar /lab activities	• Students will punctually join the class (either *on-site* or *on-line*). • If *on-site*: Students will follow the sanitary regulations in place. • Students will bring adequate writing and computing devices (laptops). • Rules of good practice will be explained by the lecturer at the beginning of the semester and will be followed accordingly by all participants to the class. • During class, students will keep their mobile phones and any other gadgets on silent mode and out of sight.

6.1. Specific competencies acquired [1]

Professional/essential competencies	• Definition of notions, concepts, theories, and advanced models in the field of chemistry and chemical process engineering, as well as their adequate use within the professional community. • Use of advanced knowledge in the field of chemistry and chemical process engineering to explain and interpret chemical processes, as well as their elements of risk and safety. • Identification and proper usage of concepts, method, and theories for solving new complex problems of risk management within chemical process engineering. • Critical analysis and usage of principles, methods, and advanced work techniques for qualitative and semi-quantitative assessment of chemical process engineering.
Transversal competencies	• Independent execution of complex professional duties and research projects by both using computer-aided techniques and complying with professional ethics and moral. • Planning, monitoring and assuming professional duties of underline group. Proving the coordination capabilities, analytical thinking, adaptability and flexibility, collaboration with team members. • Auto-evaluation of professional performances and establishing the needs of continuous learning, documentation in the work fields in correlation with the labor market.

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

7.1 General objective of the discipline	• Qualitative and semi-quantitative evaluation of risk and operational safety factors.
7.2 Specific objective of the discipline	• Ability to assess de risk and operational safety factors qualitatively and quantitatively within a process, as applied to the chemical industry. • Ability of management and operational solution proposal for avoiding as well as coping with risky situations, as applied to the chemical industry.

8. Content

[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.

Facultatea de Chimie și Inginerie Chimică

Str. Arany János nr. 11
Cluj-Napoca, cod poștal 400028
Tel.: 0264-59.38.33
Fax: 0264-59.08.18

secretariat.chem@ubbcluj.ro
www.chem.ubbcluj.ro

8.1 Course	Teaching methods	Remarks
8.1.1. Introduction. The importance of risk studies. The concepts of hazard, risk and layer of protection analysis. Examples of daily life (Covid 19).	Presentation; Explanation, Conversation; Description; Debate	Alocated time = 2 hours
8.1.2. Hazard and risk studies as part of *green engineering* and sustainability in chemical industries. Legal aspects of safety and security in chemical industry. Principles of inherently safer design.	Presentation; Explanation, Conversation; Description; Debate	Alocated time = 2 hours
8.1.3. Identification and analysis of hazard by chemical species – part 1: Hazard by chemical species. Greenhouse gases. Waste. Labelling of chemical species and waste. Analysis sheet of hazardous chemicals. Risk and security phrases.	Presentation; Explanation, Conversation; Description; Debate	Alocated time = 2 hours
8.1.4. Identification and analysis of hazard by chemical species – part 2: Storage, manipulation and transport of chemicals; labelling for these purposes. Aspects of European and Romanian legislation with respect to chemicals. Data bases for chemicals. Classification and inventory of chemical species. Individual protection equipment for workers.	Presentation; Explanation, Conversation; Description; Debate	Alocated time = 2 hours
8.1.5. Identification and analysis of hazard by technology and industrial equipment.	Presentation; Explanation, Conversation; Description; Debate	Alocated time = 2 hours
8.1.6. Event scenario identification: fault tree analysis.	Presentation; Explanation, Conversation; Description; Debate	Alocated time = 2 hours
8.1.7. Event scenario identification: event tree analysis. The “bow-tie” diagram. Identification and importance of protection layers at local and broader level. Inherently safer design.	Presentation; Explanation, Conversation; Description; Debate	Alocated time = 2 hours
8.1.8. Evaluation of event frequency and consequences. The risk matrix. Risk levels, their classification and description. The concept of tolerable risk.	Presentation; Explanation, Conversation; Description; Debate	Alocated time = 2 hours
8.1.9. Methods of qualitative risk assessment: Preliminary hazard list; Preliminary hazard analysis; Hazard and operability (HAZOP) studies. The use of risk matrixes.	Presentation; Explanation, Conversation; Description; Debate	Alocated time = 2 hours
8.1.10. Methods of semi-quantitative risk assessment: the indicator based approach. The hazard index, the vulnerability index and the risk index. Case study. Comparison among methods of qualitative and semi-quantitative risk assessment methods.	Presentation; Explanation, Conversation; Description; Debate	Alocated time = 2 hours
8.1.11. Stages of risk management. Stages of risk assessment. Steps and means of event prevention and risk mitigation (al local and broader level).	Presentation; Explanation, Conversation; Description; Debate	Alocated time = 2 hours

Facultatea de Chimie şi Inginerie Chimică
Str. Arany János nr. 11
Cluj-Napoca, cod poştal 400028
Tel.: 0264-59.38.33
Fax: 0264-59.08.18

secretariat.chem@ubbcluj.ro
www.chem.ubbcluj.ro

8.1.12. Methods of risk mitigation as a function of involved hazard types. Layer of protection analysis.	Presentation; Explanation, Conversation; Description; Debate	Alocated time = 2 hours
8.1.13. Political, financial, social and environmental hazard. Methods of risk mitigation in case of these types of hazard. Individual risk. Institutional measures for individual risk mitigation.	Presentation; Explanation, Conversation; Description; Debate	Alocated time = 2 hours
8.1.14. Soft instruments available on the market. Legal aspects (Romania and the European Union).	Presentation; Explanation, Conversation; Description; Debate	Alocated time = 2 hours

Bibliography

1. Class notes in electronic format, as well as various materials provided by the teacher during the semester.
2. Gh. Maria, „*Evaluarea cantitativă a riscului proceselor chimice şi modelarea consecinţelor accidentelor*", Editura Printech, Bucureşti, 2007.
3. A. Ozunu, C. Anghel, „*Evaluarea riscului tehnologic şi securitatea mediului*", Editura Accent, Cluj-Napoca, 2007.
4. Z. Török, N. Ajtai, A. Ozunu, „*Aplicaţii de calcul pentru evaluarea riscului producerii accidentelor industriale majore ce implică substanţe periculoase*", Editura EFES, Cluj-Napoca, 2011.
5. Th. Meyer, G. Reniers, „*Engineering Risk Management*", DeGruyter, Berlin, 2013.
6. M. Gavrilescu, „*Estimarea şi managementul riscului*", Editura Ecozone, Iaşi, 2008.

8.2 **Seminar** (*in modules of 2 hours each*). Note: The examples are prepared by the students in work groups and discussed by all during class activities.	Teaching methods	Remarks
8.2.1. Identification and analysis of hazard by chemical species. Examples.	Explanation, Conversation; Description; Debate; Problem solving	Alocated time = 2 hours
8.2.2. Identification and analysis of hazard by technology and industrial equipment. Examples.	Explanation, Conversation; Description; Debate; Problem solving	Alocated time = 2 hours
8.2.3. Event scenario identification: fault tree analysis. Examples.	Explanation, Conversation; Description; Debate; Problem solving	Alocated time = 2 hours
8.2.5. Event scenario identification: event tree analysis. "Bow-tie" diagrams. Examples.	Explanation, Conversation; Description; Debate; Problem solving	Alocated time = 2 hours
8.2.5. Evaluation of event frequency and consequences. The risk matrix. Examples.	Explanation, Conversation; Description; Debate; Problem solving	Alocated time = 2 hours
8.2.6. Hazard and operability studies. Methods of risk mitigation. Layer of protection analysis. Examples.	Explanation, Conversation; Description; Debate; Problem solving	Alocated time = 2 hours
8.2.7. Indicator based risk assessment. Social, economic, financial, political and individual risk. Examples.	Explanation, Conversation; Description; Debate; Problem solving	Alocated time = 2 hours

Bibliography

1. Class notes in electronic format, as well as **various materials provided by the teacher** during the semester.
2. Z. Török, N. Ajtai, A. Ozunu, „*Aplicaţii de calcul pentru evaluarea riscului producerii accidentelor industriale majore ce implică substanţe periculoase*", Editura EFES, Cluj-Napoca, 2011.
3. Th. Meyer, G. Reniers, „*Engineering Risk Management*", DeGruyter, Berlin, 2013.

8.3. **Practical works** (*in modules of 2 to 4 hours*). Note: The examples are prepared by the	Teaching methods	Remarks

students in work groups and discussed by all during class activities.		
8.3.1. Case study about a major incident related to chemical industry: identification of hazard triangle; presentation of risk; presentation of the event, its consequences, of mitigation actions and possible legislation outcomes; methods that might have prevented the event – Part 1.	Explanation, Conversation; Debate; Problem solving	Alocated time = 2 hours
8.3.2. Case study about a major incident related to chemical industry: identification of hazard triangle; presentation of risk; presentation of the event, its consequences, of mitigation actions and possible legislation outcomes; methods that might have prevented the event – Part 2.	Explanation, Conversation; Debate; Problem solving	Alocated time = 2 hours
8.3.3. Case study about a major incident related to chemical industry: identification of hazard triangle; presentation of risk; presentation of the event, its consequences, of mitigation actions and possible legislation outcomes; methods that might have prevented the event – Part 3.	Explanation, Conversation; Debate; Problem solving	Alocated time = 2 hours
8.3.4. Case study about a major incident related to chemical industry: identification of hazard triangle; presentation of risk; presentation of the event, its consequences, of mitigation actions and possible legislation outcomes; methods that might have prevented the event – Part 4.	Explanation, Conversation; Debate; Problem solving	Alocated time = 2 hours
8.3.5. Case study about a major incident related to chemical industry: identification of hazard triangle; presentation of risk; presentation of the event, its consequences, of mitigation actions and possible legislation outcomes; methods that might have prevented the event – Part 5.	Explanation, Conversation; Debate; Problem solving	Alocated time = 2 hours
8.3.6. Case studies about financial, social, political, economic, and environmental risk.	Explanation, Conversation; Debate; Problem solving	Alocated time = 2 hours
8.3.7. Case studies about individual risk. Measures of work safety and security in chemical industry. Some legal aspects (Romania and the European Union).	Explanation, Conversation; Debate; Problem solving	Alocated time = 2 hours
Bibliography 1. Class notes in electronic format, as well as **various materials provided by the teacher** during the semester. 2. Specific references for each case study.		

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 instructing the theoretical and practical concepts of **"Assessment of risk, safety and security factors"** course, the students will get the knowledge in accordance with the competencies included in the Diploma Supplement and the qualifications from ANC.

Facultatea de Chimie și Inginerie Chimică

Str. Arany János nr. 11
Cluj-Napoca, cod poștal 400028
Tel.: 0264-59.38.33
Fax: 0264-59.08.18

secretariat.chem@ubbcluj.ro
www.chem.ubbcluj.ro

10. Evaluation

Activity type	10.1 Evaluation criteria	10.2 Evaluation methods	10.3 Percentage of final grade
10.4 Course	Correctness of answers – proper understanding and learning of concepts discussed during lectures. Correct use of learned concept within new contexts.	**Summative evaluation**: Exam that consists in the written presentation of a qualitative risk assessment study for an equipment of the chemical industry, which has been designed by the student as part of her/his graduation thesis. Evaluation is based on requirements announced at the beginning of the semester. Proven or intended fraud is treated according to the ECST rules of UBB.	50 %
10.5 Seminar/laboratory	Correctness of answers – proper understanding and learning of concepts discussed during class; Correct use of learned concept within new contexts. **Presentations of case studies during seminar / practical works is compulsory.**	**Formative evaluation**: - **Seminar**: Presentation of examples (individually or in work groups) regarding aspects discussed during the lectures. Evaluation is carried out on the spot. - **Practical works**: Presentation of a case study (individually or in work groups) regarding a major event in chemical industry. Evaluation is based on requirements announced at the beginning of the semester. Proven or intended fraud is treated according to the ECST rules of UBB.	20% 30%
10.6 Minimum standard of performance			
• Satisfying the requirements of seminar and practical works (formative evaluation) as well as obtaining at least the grade 5 (five) at the end of semester, when the final grade of this discipline is calculated as a weighted average (see above for weights) between the formative and summative evaluation results. • Adequate knowledge and usage of discussed concepts and methods.			

Facultatea de Chimie și Inginerie Chimică

Str. Arany János nr. 11
Cluj-Napoca, cod poștal 400028
Tel.: 0264-59.38.33
Fax: 0264-59.08.18

secretariat.chem@ubbcluj.ro
www.chem.ubbcluj.ro

11. Labels ODD (Sustainable Development Goals)[2]

	Quality Education

Date:
14.04.2025

Signature of course coordinator

Assoc. Prof. dr. eng. Alexandra Ana Csavdari

Signature of seminar coordinator

Assoc. Prof. dr. eng. Alexandra Ana Csavdari

Date of approval:
15.04.2025

Signature of the head of department

Prof. Habil. Dr. Eng. Graziella Liana Turdean

[2] Keep only the labels that, according to the *Procedure for applying ODD labels in the academic process*, suit the discipline and delete the others, including the general one for *Sustainable Development* – if not applicable. If no label describes the discipline, delete them all and write „*Not applicable*.".