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	Advanced Chemical Process Engineering

2. Information regarding the discipline

2.1 Name of the discipline	**Assessment of risk, safety and security factors – CME7321**						
2.2 Course coordinator	Assoc. Prof. Dr. Eng. Alexandra Csavdári						
2.3 Seminar / laboratory work coordinator	Assoc. Prof. Dr. Eng. Alexandra Csavdári						
2.4. Year of study	II	2.5 Semester	3	2.6. Type of evaluation	E	2.7 Type of discipline	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/laboratory	14/14
Time allotment:					hours
Learning using manual, course support, bibliography, course notes					14
Additional documentation (in libraries, on electronic platforms, field documentation)					12
Preparation for seminars/labs, homework, papers, portfolios and essays					28
Tutorship					12
Evaluations					3
Other activities: not the case					-

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

5. Conditions (if necessary)

5.1. for the course	• The students will turn off their mobile phones • Delays will not be tolerated
5.2. for the seminar /lab activities	• Students will bring to the laboratory practice their course notes and appropriate calculus device

	• Students will turn off their mobile phones • Delays will not be tolerated

6. Specific competencies acquired

Professional 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 quantitative and qualitative assessment of chemical process engineering.
Transversal competencies	• Independent execution of complex professional duties and research projects using computer-aided techniques and comply 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 establish the needs of continuous learning, documentation in the work fields in correlation with the labour market.

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

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

8. Content

8.1 Course	Teaching methods	Remarks
8.1.1. Introduction. Presentation of examples of some major technological accidents. The importance of risk studies. Definition of specific concepts.	Presentation; Explanation, Conversation; Description; Debate	Alocated time = 2 hours
8.1.2. Basic concept regarding events and their probability.	Presentation; Explanation, Conversation; Description; Debate	Alocated time = 2 hours
8.1.3. Models and framework. Simulation and reality.	Presentation; Explanation, Conversation; Description; Debate	Alocated time = 2 hours
8.1.4. Deterministic and probabilistic methods. Random and epistemic uncertainty.	Presentation; Explanation, Conversation; Description; Debate	Alocated time = 2 hours
8.1.5. Safety, risk and reliability	Presentation; Explanation, Conversation; Description; Debate	Alocated time = 2 hours
8.1.6. Risk, its nature, the risk index.	Presentation; Explanation,	Alocated

	Conversation; Description; Debate	time = 2 hours
8.1.7. Consequences of breaking. Stages of basic risk evaluation.	Presentation; Explanation, Conversation; Description; Debate	Alocated time = 2 hours
8.1.8. Qualitative assessment techniques. The risk matrix. The tree method. Chain of events.	Presentation; Explanation, Conversation; Description; Debate	Alocated time = 2 hours
8.1.9. Markov chains. Effect analysis.	Presentation; Explanation, Conversation; Description; Debate	Alocated time = 2 hours
8.1.10. Quantitative assessment techniques. Probabilistic assessment – part 1.	Presentation; Explanation, Conversation; Description; Debate	Alocated time = 2 hours
8.1.11. Quantitative assessment techniques. Probabilistic assessment – part 2.	Presentation; Explanation, Conversation; Description; Debate	Alocated time = 2 hours
8.1.12. Semi-quantitative assessment techniques.	Presentation; Explanation, Conversation; Description; Debate	Alocated time = 2 hours
8.1.13. Integrated risk analysis techniques.	Presentation; Explanation, Conversation; Description; Debate	Alocated time = 2 hours
8.1.14. Case studies.	Presentation; Explanation, Conversation; Description; Debate	Alocated time = 2 hours

Bibliography

1. Alexandru Ozunu, Călin Anghel: Evaluarea riscului tehnologic şi securitatea mediului, Ed. Accent, Cluj-Napoca, 2007.
2. Török Zoltán, Ajtai Nicolae, Ozunu Alexandru: Aplicaţii de calcul pentru evaluarea riscului producerii accidentelor industriale majore ce implică substanţe periculoase, Ed. EFES, Cluj-Napoca, 2011.
3. Gheorghe Maria: Evaluarea cantitativă a riscului proceselor chimice şi modelarea consecinţelor accidentelor, Ed. Printech, Bucureşti, 2007.
4. Meyer Thierry, Reniers Genserik: Engineering Risk Management, DeGruyter, Berlin, 2013.

8.2 Seminar	Teaching methods	Remarks
8.2.1. Structure of technological risk analysis in chemical industry	Explanation, Conversation; Description; Debate; Problem solving	Alocated time = 2 hours
8.2.2. Qualitative risk analysis (part 1): Dangerous chemicals; Preliminary hazard analysis.	Explanation, Conversation; Description; Debate; Problem solving	Alocated time = 2 hours
8.2.3. Qualitative risk analysis (part 2): Hazard and operability study; Analysis of errors and their effects.	Explanation, Conversation; Description; Debate; Problem solving	Alocated time = 2 hours
8.2.5. Quantitative risk analysis (part 1): Error tree; Event tree.	Explanation, Conversation; Description; Debate; Problem solving	Alocated time = 2 hours
8.2.5. Quantitative risk analysis (part 2): Analysis of effects and consequences	Explanation, Conversation; Description; Debate; Problem solving	Alocated time = 2 hours
8.2.6. Estimation and presentation of technological risk. Individual and social risk.	Explanation, Conversation; Description; Debate; Problem solving	Alocated time = 2 hours

8.2.7. Legislation aspects (Romania and European Union). Scenarios and case studies.	Explanation, Conversation; Description; Debate; Problem solving	Alocated time = 2 hours
Bibliography 1. Török Zoltán, Ajtai Nicolae, Ozunu Alexandru: Aplicaţii de calcul pentru evaluarea riscului producerii accidentelor industriale majore ce implică substanţe periculoase, Ed. EFES, Cluj-Napoca, 2011. 2. Meyer Thierry, Reniers Genserik: Engineering Risk Management, DeGruyter, Berlin, 2013.		

8.3. Individual project (practical work) – The project topic refers to an installation used in chemical industry, that was designed by the student himself either in hers/his diploma thesis or in hers/his master thesis. It applies all concepts discussed during the seminar	Teaching methods	Remarks
8.3.1. Structure of technological risk analysis in chemical industry	Explanation, Conversation; Debate; Problem solving	Alocated time = 2 hours
8.3.2. Qualitative risk analysis (part 1): Dangerous chemicals; Preliminary hazard analysis.	Explanation, Conversation; Debate; Problem solving	Alocated time = 2 hours
8.3.3. Qualitative risk analysis (part 2): Hazard and operability study; Analysis of errors and their effects.	Explanation, Conversation; Debate; Problem solving	Alocated time = 2 hours
8.3.5. Quantitative risk analysis (part 1): Error tree; Event tree.	Explanation, Conversation; Debate; Problem solving	Alocated time = 2 hours
8.3.5. Quantitative risk analysis (part 2): Analysis of effects and consequences	Explanation, Conversation; Debate; Problem solving	Alocated time = 2 hours
8.3.6. Estimation and presentation of technological risk. Individual and social risk.	Explanation, Conversation; Debate; Problem solving	Alocated time = 2 hours
8.3.7. Legislation aspects (Romania and European Union).	Explanation, Conversation; Debate; Problem solving	Alocated time = 2 hours
Bibliography 1. Török Zoltán, Ajtai Nicolae, Ozunu Alexandru: Aplicaţii de calcul pentru evaluarea riscului producerii accidentelor industriale majore ce implică substanţe periculoase, Ed. EFES, Cluj-Napoca, 2011.		

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 requested by possible employment sectors stetted by RNCIS.

10. Evaluation

Type of activity	10.1 Evaluation criteria	10.2 Evaluation methods	10.3 Share in the grade (%)
10.4 Course	Correctness of answers – proper understanding and learning of concepts discussed during lectures; Correct use of learned concept within new contexts.	Written exam. Proven or intended fraud is treated according to the ECST rules of UBB.	60 %
	Correct solving of problems as inherent part		

	of examination subjects.		
10.5 Seminar / Individual project (Practical works)	Correctness of answers – proper understanding and learning of concepts discussed during class; Correct use of learned concept within new contexts.	Evaluated by means of problems to be solved, as inherent part of the exam subjects.	-
	Correctness od calculus and aspects presented within the individual project topic	Evaluated separately during the semester, with final mark at the end of semester when handing in the complete project.	40 %

10.6 Minimum performance standards
➢ Grade 5 (five) at the written exam. ➢ Adequate knowledge and usage of discussed concepts and methods.

Date	Signature of course coordinator	Signature of seminar coordinator
February 22nd, 2018	Assoc. Prof. Dr. Eng. Alexandra Csavdári	Assoc. Prof. Dr. Eng. Al. Csavdári

Date of approval	Signature of the head of department
February 26th, 2018	Assoc. Prof. Dr. Eng. G. L. Turdean