COURSE SYLLABUS

1. Data about the program

1.1 Higher education institution	Babeș-Bolyai University
1.2 Faculty	Faculty of Environmental Science and Engineering
1.3 Doctoral school	Doctoral School of Environmental Science
1.4 Field of study	Environmental Science
1.5 Study cycle	Doctorate
1.6 Study program / Qualification	Doctoral training / PhD in Environmental Science

2. Course data

2.1 Name of discipline	Risk and vulnerability assessment and environmental crises						
2.2 Teacher responsible for lectures	Professor Alexandru Ozunu						
2.3 Teacher responsible for seminars	Professor Alexandru Ozunu						
2.4 Year of study	1	2.5 Semester	1	2.6. Type of evaluation	E	2.7 Course framework	Optional

3. Estimated total time of teaching activities (hours per semester)

3.1 Hours per week	3	Out of which: 3.2 Lectures	2	3.3 Seminars / Laboratory classes	1
3.4 Total hours in the curriculum	36	Out of which: 3.5 Lectures	24	3.6 Seminars / Laboratory classes	12

Allocation of study time:	h
Study supported by textbooks, other course materials, recommended bibliography and personal student notes	24
Additional learning activities in the library, on specialized online platforms and in the field	12
Preparation of seminars / laboratory classes, topics, papers, portfolios and essays	12
Tutoring	
Examinations	2
Other activities: -	
3.7 Individual study (total hours)	
3.8 Total hours per semester	
3.9 Number of credits	

4. Preconditions (where applicable)

4.1 Curriculum	• knowledge of the fundamental elements of environmental science and engineering
4.2 Competences	• teamwork, case study design, knowledge in the field

5. Conditions (where applicable)

5.1 Conducting lectures	• requires digital projector and laptop
5.2 Conducting seminars / laboratory classes	• requires digital projector and laptop

6. Specific competences acquired

Professional competences	• knowledge of the concepts and principles of performing a risk analysis • acquiring knowledge in order to conduct social vulnerability assessments.
Transversal competences	• the ability to conduct literature research in all existing formats • knowledge regarding the use of computer programs • acquiring the knowledge necessary to conduct a research project • teamwork

7. Course objectives (based on the acquired competencies grid)

7.1 The general objective of the course	• assessing the different types of risks and their potential consequences, as well as the aspects that influence the individual and societal vulnerability
7.2 Specific objectives	• mastering the risk assessment terminology • studying and learning the methods, techniques and procedures for risk assessment • learning how to carry out a technological risk analysis project • assessing the vulnerability of communities to various hazards • identifying risk reduction strategies • knowledge of the strategies and methodologies for vulnerability mitigation • investigation of the historically contaminated sites • risk assessment for historically contaminated sites • knowledge of the methods for restoring the contaminated environment • identifying the critical infrastructure threats • critical infrastructure protection measures

8. Content

8.1 Lectures	Teaching methods	Comments
1. Introduction - definitions, concepts, principles, theories, methodologies - hazard, vulnerability, environmental risks	Lecture, interactive discussions	4C
2. Vulnerability from the perspective of natural and technological disasters approach - Basic principles, theories and methodologies for measuring and reducing the vulnerability	Lecture, interactive discussions	4C
3. EU methodologies for environmental risks analysis and assessment at national level	Lecture, interactive discussions	4C
4. Hazard, vulnerability and risk maps	Lecture, interactive discussions	2C
5. Case studies – natural risks specific to Romania	Lecture, interactive discussions	2C

6. Multi-risk case studies: earthquake combined with toxic dispersion	Lecture, interactive discussions	2C
7. Unitary methodology for national environmental risk assessment, country report	Lecture, interactive discussions	2C
8. Historically contaminated industrial sites - risk assessment	Lecture, interactive discussions	2C
9. Debates on individual projects	Lecture, interactive discussions	2C

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. Alexandru Ozunu, Călin Anghel: Evaluarea riscului tehnologic şi securitatea mediului, Ed. Accent, Cluj-Napoca, 2007.
3. EC, (European Commission), 2006, Proposal for a Directive of the European Parliament and of the Council establishing a framework for the protection of soil and amending Directive 2004/35/EC, Brussels, 22.9.2006;
4. EC, (European Commission), 2006, European Commission. Thematic Strategy for Soil Protection Communication (COM(2006) 231
5. Grigore Alexandrescu, Gheorghe Văduva: Infrastructuri critice. Pericole, ameninţări la adresa acestora. Sisteme de protecţie, Editura Universităţii Naţionale de Apărare „Carol I", 2006
6. Alexander Fekete: Common Criteria for the Assessment of Critical Infrastructures, Int. J. Disaster Risk Sci. 2011, 2 (1): 15–24
7. Wolfgang Kröger: Critical infrastructures at risk: A need for a new conceptual approach and extended analytical tools, Reliability Engineering and System Safety 93 (2008) 1781– 1787
8. Villagrán De León, Juan Carlos, (2006), Vulnerability: A Conceptual and Methodological Review, Studies of the University: Research, Counsel, Education, Publication Series of UNU-EHS, No.4/2006
9. Wisner, B., Blaikie, P., Cannon, T., Davis, I., (2004), At Risk: Natural Hazards, People's Vulnerability and Disasters, second ed. Routledge, London.
10. Török, Zoltán, 2010, Analize calitative şi cantitative în managementul riscului în sectorul industrial chimic, Universitatea Babeş-Bolyai, teză de doctorat
11. Ajtai, Nicolae, 2012, Optoelectronic Techniques for Atmospheric Monitoring used for the assessment of Natural Hazards and Technological Risks, Universitatea Babeş-Bolyai, teză de doctorat
12. Costan, Camelia, 2010, Riscuri naturale şi tehnologice în Bazinul mijlociu al râului Arieş. Reducerea vulnerabilităţii comunităţilor locale, Universitatea Babeş-Bolyai, teză de doctorat
13. Stezar, Codruţa, 2012, Evaluarea riscului de mediu pentru amplasamente industriale contaminate istoric cu poluanţi chimici, Universitatea Babeş-Bolyai, teză de doctorat
14. Crişan, Diana, 2013, Influenţa hazardelor naturale asupra infrastructurii critice, Universitatea Babeş- Bolyai, teză de doctorat

8.2 Seminars / laboratory classes	Teaching methods	Comments
1. Hazard, vulnerability and risk maps	Lecture Teamwork Brainstorming	2S
2. Case studies – natural risks specific to Romania	Lecture Teamwork Brainstorming	2S
3. Multi-risk case studies: earthquake combined with toxic dispersion	Lecture Teamwork Brainstorming	2S
4. Unitary methodology for national environmental risk assessment, country report	Lecture Teamwork Brainstorming	2S
5. Historically contaminated industrial sites - risk assessment	Lecture Teamwork Brainstorming	2S

6. Case studies specific to the PhD topics and the individual projects	Lecture Teamwork Brainstorming	2S

Bibliography:
1. Gheorghe Maria: Evaluarea cantitativă a riscului proceselor chimice şi modelarea consecinţelor accidentelor, Ed. Printech, Bucureşti, 2007.
2. Frank P. Lees: Loss Prevention in the Process Industries: Hazard Identification, Assessment and Control, Second edition, United Kingdom, 1996.
3. Van den Bosch, C. J. H., Weterings R.A.P.M: „Yellow Book": Methods for the Calculation of Physical Effects, Third edition, Committee for the Prevention of Disasters, Netherlands, 1997.
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5. Ghoerghe A.V., Mock R., Risk Engineering - Bridging Risk Analysis with Stakeholders Values, Kluwer Academic Publishers,1999.
6. Seth D.Guikema, Natural disaster risk analysis for critical infrastructure systems: An approach based on statistical learning theory, Reliability Engineering and System Safety Journal, no. 94, pag 855–860, 2009.
7. Birkmann, J. (Ed.), (2006), Measuring Vulnerability to Natural Hazards—Towards Disaster-Resilient Societies. United Nations University, Tokyo, New York.
8. Clark, William C., (2000), Assessing Vulnerability to Global Environmental Risks, Research and Assessment Systems for Sustainability Project Environment and Natural Resources Program
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10. Pelling, M., (2004), Visions of Risk: A Review of International Indicators of Disaster Risk and its Management, UNDP—Bureau for Crisis Prevention and Recovery (BRCP), Geneva.
11. Gheorghiu A.-D., Ozunu Al., 2013, Natech accidents and ethical decision making (Accidentele natech si etica luarii deciziilor) – in English and Romanian, Environmental Engineering and Sustainable Development Entrepreneurship (Ingineria Mediului şi Antreprenoriatul Dezvoltării Durabile), Vol. 2, No. 2-2013, 57-64
12. Ozunu, A., Senzaconi, F., Botezan, C., Ştefănescu, L., Nour, E., and Balcu, C., 2011, Investigations on natural hazards which trigger technological disasters in Romania, Nat. Hazards Earth Syst. Sci., 11, 1319- 1325, doi:10.5194/nhess-11-1319-2011
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16. Stezar I. C., Ozunu A., Barry D. L., 2013, The role of stakeholder attitudes in managing contaminated sites: survey of Romanian stakeholder awareness, Environ Sci Pollut Res, DOI 10.1007/s11356-013-2238-0
17. Gheorghiu A. D., Török Z., Ozunu A., 2013, How can existing risk assessment methodologies be used in a systematic manner, in the extractive mining industry?, Accepted for publication in Journal of Environmental Protection and Ecology (JEPE), Vol. 14, ISSN: 1311-5065 (IF: 0.178)

9. Aligning the contents of the discipline with the expectations of the epistemic community representatives, professional associations and standard employers operating in the program field

- the knowledge acquired during the course can be used in the fields of: environmental protection, emergency management, disaster reduction and in the academic field.

10. Examination

Activity type	10.1 Evaluation criteria	10.2 Evaluation methods	10.3 Weight in the final grade
10.4 Lectures	Correctness of the answers	Written exam	70%

10.5 Seminars / laboratory classes	Activity during seminars		5%
	Project presentation	Oral exam	25%
10.6 Minimum performance standard			
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Date of issue	Signature of the teacher responsible for lectures	Signature of the teacher responsible for seminars
01.10.2022		

Date of approval by the doctoral school council

03.10.2022

Signature of the doctoral school director