DESCRIPTION OF CHANGES AND ADDITIONS TO UNDERGRADUATE, GRADUATE AND INTEGRATED UNDERGRADUATE AND GRADUATE STUDY PROGRAMMES

1. GENERAL INFORMATION ON THE STUDY PROGRAMME				
1.1. Name of the study programme	Environmental Geology			
1.2. Provider of the study programme				
1.3. Type of study programme	Vocational study programme ☐		University study programme X ☐	
1.4. Level of study programme	Undergraduate ☐	Graduate X ☐	Integrated ☐	Postgraduate specialist ☐
1.5. Manner of implementation of the study programme	Classical X ☐	Mixed (classical + online) ☐	Online in entirety ☐	
1.6. Academic/vocational title earned at completion of study	Master of sciences in Geology			
1.7. Total number of ECTS credits	Before the change	120	After the change	120
1.8. Faculty Council decision on acceptance of changes and additions (enclose)				
1.9. Volume of changes and additions to the study programme	Number of ECTS credits of the unchanged part of the programme:	103		
	Number of ECTS credits of the changed part of the programme:	17		
1.10. Ordinal number of changes and additions to the study programme:		1.11. Estimate of the percentage of changes and additions to the study programme	Less than 20% x ☐ More than 20% and less than 40% ☐ More than 40% ☐	

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Table 1. Description of changes and additions to the study programme

What changes are made/What additions are made	Number of ECTS credits of the course being changes	Before the change	After the change	Explanation of the change
New elective course **Methods of remote sensing in geology** is introduced as a new course at the Graduate study of Geology and Graduate study of Environmental geology in 2010.	+5	0	5	The course is introduced in Geology and paleontology module and Geology of the environment protection module. The course is introduced as a complementary course and building over the courses of Geological mapping I and II which are being taught at the Undergraduate study of geology. The purpose of the course is to acquaint the students with methods of remote sensing and provide necessary knowledge to interpret the geological structures on aerial photographs and satellite images, particularly in hardly accessible and unsafe areas.
Compulsory course **Regional geology and global tectonics** in 1st year of Graduate study of Geology is discontinued in 2010.	-5	5	0	The course is partly substituted by course Plate tectonics.
New compulsory course **Plate tectonics** is introduced in 1st year of Graduate study of Geology in 2010.	+3	0	3	The course is partial replacement of the previous course Regional geology and global tectonics.
New compulsory course **Geology of Croatia** is introduced at the Graduate study of Geology in 2010.	+2	0	2	The course is re-introduced after several years, to suite the students' needs for better understanding of the geology of Croatia.
The elective course **Zooarcheology** is introduced at the Graduate study of Geology in 2010.	+5	0	5	The course is introduced in Geology and paleontology module, and Geology of the environment protection module.
New compulsory course **Individual field project** is introduced at 2nd year of Graduate study of Geology and 2nd year of Graduate study of Environmental Geology in 2008. godine	+12	0	+12	The course is re-introduced after several years, to suite the students' needs for better field knowledge.

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Table 2. Description of the new course or the course to which changes and additions are made
*** Copy the table for each proposed new course, or course to which changes and additions are made**

1. COURSE DECRIPTION – GENERAL INFORMATION			
1.1. Course teacher	Tihomir Marjanac, associate professor	1.6. Year of study	1st / 2nd
1.2. Name of the course	**Methods of Remote sensing in Geology**	1.7. Credit value (ECTS)	5
1.3. Associate teachers		1.8. Type of instruction (number of hours L+S+E+e-learning)	30+0+15+0
1.4. Study programme (undergraduate, graduate, integrated)	Graduate study of Geology, Graduate study of Environmental geology	1.9. Expected enrolment in the course	4-5
1.5. Status of the course	Elective	1.10. Level of use of e-learning (1, 2, 3 level), percentage of instruction in the course on line (20% maximum)	1
2. COURSE DESCRIPTION			
2.1. Course objectives	Familiarizing with remote sensing principles, methods, applications and limitations.		
2.2. Enrolment requirements and required entry competences for the course	Understanding of basic principles of Physical Geology, elementary Physics, basic knowledge of Geological mapping. Motivation for study of remote sensing principles is essential.		
2.3. Learning outcomes at the level of the study programme to which the course contributes	Mastering basic skills for geological interpretation of well-exposed territory, based on analysis of aerial and satellite images.		
2.4. Expected learning outcomes at the level of the course (4-10 learning outcomes)	Mastering skills for recognition and interpretation of lithology, sedimentary bodies, tectonical structures, both in well-exposed and poorly exposed terrains, skills to interpret aerial photographs and produce a photo-geological map. Successful students should be competent to use various photographic sources for remote sensing-based study; aerial photographs, ortophotographs, single-channel and multi-channel satellite images.		
2.5. Course content broken down in detail by weekly class schedule (syllabus)	1) Remote sensing, types, principles, application in Geology. 2) Waves, electromagnetic spectrum, colors, effects of atmosphere. 3) Sensors, properties, resolution. 4) Photographing procedures, aerial phoitographs, satellite imagery, wave lengths, types and properties of images. 5) Aerial photographs, photograms. 6) Properties and types of satellite images. 7) Digital processing of satellite images. 8) Visual interpretation of aerial and satellite images. 9) Application of aerial and satellite images in geology and environment protection.		

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	10) Software for digital processing and analysis of satellite images. 11) Exercises in visual interpretation of aerial photographs, 12) Exercises in digital processing of multispectral satellite images. 13) Exercises in interpretation of stratigraphy and tectonics on selected satellite images.					
2.6. Type of instruction	x☐ lectures ☐ seminars and workshops x☐ exercises ☐ online in entirety ☐ mixed e-learning ☐ field work		☐ independent study ☐ multimedia and the internet ☐ laboratory ☐ work with the mentor ☐ (other)		2.7. Comments:	
2.8. Student responsibilities	Regular attendance of lectures and solving given tasks at exercises.					
2.9. Screening of student's work (specify the proportion of ECTS credits for each activity so that the total number of CTS credits is equal to the credit value of the course)*:*	Class attendance	**1**	Research		Practical training	
	Experimental work		Report			
	Essay		Seminar essay		(Other--describe)	
	Tests		Oral exam	**4**	(Other—describe)	
	Written exam		Project		(Other—describe)	
2.1. Grading and evaluation of student work over the course of instruction and at a final exam	Discussion on individual studied problems and motifs.					

2.2. Required literature (available at the library and via other media)	**Title**	**Number of copies at the library**	**Availability via other media**
	Remote sensing in Geology course DVD provided by the course leader.	For each student	DVD
	Gupta R.P. (2003): Remote Sensing Geology. 2nd ed. Springer	1	
	Oluić M. et al. (2002): Snimanje i istraživanje Zemlje iz svemira. Sateliti, Senzori, Primjena. HAZU i GEOSAT	3	
	Prost G.L. (2001): Remote Sensing for Geologists: A Guide to Image Interpretation. Taylor & Francis.	1	
	Rencz A.N. (1999): Remote Sensing for the Earth Sciences: Manual of Remote Sensing 3.ed. John Wiley & Sons	1	
	Donassy, Oluić & Tomašegović (1983): Daljinska istraživanja u geoznanostima. JAZU	5	

2.12. Optional literature (at the time of the submission of the study programme proposal)	Miller V.C. & Miller C.F. (1961): Photogeology. McGraw Hill

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2.13. Methods of monitoring quality that ensure acquisition of exit competences	Monitoring activity during lectures and exercises.

1. COURSE DECRIPTION – GENERAL INFORMATION			
1.3. Course teacher	Tihomir Marjanac, associate professor	1.11. Year of study	2nd
1.4. Name of the course	**Individual field project**	1.12. Credit value (ECTS)	7
1.4. Associate teachers	Marijan Kovačić, associate professor	1.13. Type of instruction (number of hours L+S+E+e-learning)	0+0+105+0
1.5. Study programme (undergraduate, graduate, integrated)	Graduate	1.14. Expected enrolment in the course	10
1.6. Status of the course	compulsory	1.15. Level of use of e-learning (1, 2, 3 level), percentage of instruction in the course on line (20% maximum)	

2. COURSE DESCRIPTION			
2.10. Course objectives	Mastering field and laboratory research techniques in geology, authoring a geological map and explanatory notes.		
2.11. Enrolment requirements and required entry competences for the course	Geological mapping I and II course, Field courses in geology.		
2.12. Learning outcomes at the level of the study programme to which the course contributes	Mastering basic skills and knowledge for individual geological mapping of a given territory, analysis of collected rock and fossil samples, solving geological structure and integration of all acquired data in a comprehensive report on geological composition of the studied area.		
2.13. Expected learning outcomes at the level of the course (4-10 learning outcomes)	Mastering skills for recognition and interpretation of lithologies in the field, measurement of tectonical elements and recognition of geological structures. Mastering skills and knowledge for analysis and lithological and stratigraphical interpretation of collected rock and fossil samples. Achieving competences for preparation of field geological map, geological sections and column, and preparation of a manuscript geological map and related explanatory report.		
2.14. Course content broken down in detail by weekly class schedule (syllabus)	1) Students individually perform preparation for the field research, study appropriate literature. 2) Students individually map given territory. 3) Students individually describe and analyse collected samples, study thin sections under the microscope, determine lithology of the sampled rocks, determine collected fossils and their age. 4) Students individually prepare a manuscript geological map of the studied area. 5) Students individuallly write a comprehensive report.		
2.15. Type of instruction	☐ lectures	X ☐ independent study	2.16. Comments:

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	☐ seminars and workshops ☐ exercises ☐ online in entirety ☐ mixed e-learning x ☐ field work	☐ multimedia and the internet ☐ laboratory x ☐ work with the mentor ☐ (other)	The course is essentially students' individual field and laboratory work.
2.17. Student responsibilities	Individual work in the field, obeying safety in field work, periodic reporting of work progress to dedicated mentor, obeying work and deadline schedule.		

2.18. Screening of student's work (specify the proportion of ECTS credits for each activity so that the total number of CTS credits is equal to the credit value of the course)*:*						
	Class attendance		Research	4	Practical training	
	Experimental work		Report			
	Essay		Seminar essay		(Other--describe)	
	Tests		Oral exam		(Other—describe)	
	Written exam		Project	3	(Other—describe)	

2.3. Grading and evaluation of student work over the course of instruction and at a final exam	Monitoring individual work phases, review of field performance and map, review of written report, grading of final report and geological map.

2.4. Required literature (available at the library and via other media)	**Title**	**Number of copies at the library**	**Availability via other media**
	Bahun, S.: Geološko kartiranje. Školska knjiga, Zagreb,1993.	10	
	Barnes, J.W. & Lisle, R.J: Basic Geological Mapping (fourth edition). John Wiley & Sons, Ltd, England, 2004.	1	
	Powell, D.: Interpretation of Geological Structures Trough Maps (an introductory practical manual). Longman Scientific & Technical, Group UK Ltd., 1994.	1	
	Dimitrijević, M.: Geološko kartiranje. ICS, Beograd, 1978.	2	

2.14. Optional literature (at the time of the submission of the study programme proposal)	Explanatory notes of Basic geological maps, geological publications on Medvednica and Samoborsko gorje.
2.15. Methods of monitoring quality that ensure acquisition of exit competences	Mentoring each student.

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1. COURSE DECRIPTION – GENERAL INFORMATION			
1.5. Course teacher	Jasenka Sremac, professor and Josip Halamić, associate professor	1.16. Year of study	1st
1.6. Name of the course	Geology of Croatia	1.17. Credit value (ECTS)	2
1.5. Associate teachers		1.18. Type of instruction (number of hours L+S+E+e-learning)	30+0+ 0+0
1.6. Study programme (undergraduate, graduate, integrated)	Graduate study of Geology and Graduate study of Environmental Geology	1.19. Expected enrolment in the course	12
1.7. Status of the course	Compulsory	1.20. Level of use of e-learning (1, 2, 3 level), percentage of instruction in the course on line (20% maximum)	1 (10%)
2. COURSE DESCRIPTION			
2.19. Course objectives	Synthesis and upgrade of previous knowledge in tectonics, biostratigraphy and paleogeography for the purpose of future ability of a graduate student to work in any region of Croatia.		
2.20. Enrolment requirements and required entry competences for the course	Finished undergraduate study of geology at the Faculty of Science or Faculty of Mining, Geology and Petroleum Engineering or Finished courses in Historical (Stratigraphic) geology, Geological mapping and Structural geology with geotectonics.		
2.21. Learning outcomes at the level of the study programme to which the course contributes	The ability to connect and make a synthesis of partial knowledge. Training for practical work in the profession at the area of Croatia.		
2.22. Expected learning outcomes at the level of the course (4-10 learning outcomes)	1. Understanding the regional geology of Croatia (basic megaunits) 2. Knowledge about cause-effect connections of palaeogeographic position and depositional environment. 3. Recapitulation of paleontological data and their integration with the global situation. 4. Interconnections of the present position of Croatian regions and tectonic processes through geological history. 5. Introduction to the history of geological research and development of geological ideas in Croatia.		
2.23. Course content broken down in detail by weekly class schedule (syllabus)	1. Geotectonic history of Croatia and the main structural units. 2. Karst Dinarides - early history and beginnings of development of carbonate platform (Carboniferous-Permian) 3. Karst Dinarides - stressful events at the end of the Paleozoic era, the great extinction at Permian / Triassic boundary and slow recovery during the Triassic. 4. Karst Dinarides during the Jurassic and Cretaceous - a platform type of deposition. 5. Karst Dinarides in Cenozoic era - from tropics to the glacial period.		

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	6. Internal Dinarides - the edge of the platform and its specificity. 7. Northern Croatia during the Palaeozoic era. 8. Triassic events in Northern Croatia. 9. Geological events during the Jurassic and Cretaceous in Northern Croatia. 10. Cenozoic in Northern Croatia. Formation of Paratethys and its evolution. 11. Croatia during the Pleistocene and Holocene. 12. History of geological explorations in Croatia.					
2.24. Type of instruction	x☐ lectures x☐ seminars and workshops ☐ exercises ☐ online in entirety ☐ mixed e-learning x☐ field work		☐ independent study x☐ multimedia and the internet ☐ laboratory ☐ work with the mentor ☐ (other)		2.25. Comments:	
2.26. Student responsibilities						
2.27. Screening of student's work (specify the proportion of ECTS credits for each activity so that the total number of CTS credits is equal to the credit value of the course)*:*	Class attendance	0,2	Research		Practical training	
	Experimental work		Report			
	Essay		Seminar essay	0,3	(Other--describe)	
	Tests	0,5	Oral exam		(Other—describe)	
	Written exam	1	Project		(Other—describe)	
2.5. Grading and evaluation of student work over the course of instruction and at a final exam	Regular attendance of lectures, seminar essays, tests.					

2.6. Required literature (available at the library and via other media)	**Title**	**Number of copies at the library**	**Availability via other media**
	Basic geological map 1:100 000 with 74 sheets and explanatory text. Croatian Geological Survey.	1-2 samples per sheet	CD-rom
	Croatian Geological Map 1: 300 000 with explanatory text. Croatian Geological Survey (2009). http://www.hgi-cgs.hr/osnovna-geoloska-karta.htm	2	web
	Goričan, Š.; Halamić, J.; Grgasović, T. & Kolar-Jurkovšek, T. (2005): Stratigraphic evolution of Triassic arc-backarc system in northwestern Croatia. // Bulletin de la Société géologique de France. 176 (2005) , 1; 3-22.	1	photocopies
	Pamić, J. (1997): Vulkanske stijene savsko-dravskog međuriječja i Baranje	1	photocopies

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	(Hrvatska). // Nafta, 1-192, Zagreb.		
	Pamić, J. & Jurković, I. (2002): Paleozoic tectonostratigraphic units of the northhwest and central Dinarides and the adjoining South Tisia. J.Earth Sci. (Geol. Rundschau), 91, 538-554.	1	photocopies
	Vozarova,A.; Ebner,F.; Kovacs,S.; Kräutner, H.-G.; Szederkenyi, T.; Krstić,B.; Sremac, J.; Aljinović,D.; Novak,M. & Skaberne,D. (2009): Late Variscan (Carboniferous to Permian) environments in the Circum Pannonian Region. // Geologica Carpathica, 60/1, 71-104.	1	web
2.16. Optional literature (at the time of the submission of the study programme proposal)	Scientific and professional articles by Croatian and other authors concerning geology of Croatia, available in libraries of Faculty of Science and/or Croatian Geological Survey.		
2.17. Methods of monitoring quality that ensure acquisition of exit competences	Students evaluations (questionary).		

1. COURSE DECRIPTION – GENERAL INFORMATION			
1.7. Course teacher	Ervin Mrinjek, assistant professor	1.21. Year of study	1st
1.8. Name of the course	Tectonic plate	1.22. Credit value (ECTS)	3
1.6. Associate teachers		1.23. Type of instruction (number of hours L+S+E+e-learning)	30+0+15+0
1.7. Study programme (undergraduate, graduate, integrated)	Graduate study of Geology and Graduate study of Environmental Geology	1.24. Expected enrolment in the course	20
1.8. Status of the course	Compulsory	1.25. Level of use of e-learning (1, 2, 3 level), percentage of instruction in the course on line (20% maximum)	1
2. COURSE DESCRIPTION			
2.28. Course	Basic knowledge on plate dynamics (on plane and sphere), basic knowledge on magnetostratigraphy and Earth magnetism,		

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objectives	basic knowledge on seismology and plate dynamics.					
2.29. Enrolment requirements and required entry competences for the course	Physical geology Structural geology, petrological courses.					
2.30. Learning outcomes at the level of the study programme to which the course contributes	Knowledge on plate tectonics as "driving force" of all geological processes in litoshere and on Earth surface.					
2.31. Expected learning outcomes at the level of the course (4-10 learning outcomes)	Course integrates plate motion and origin of sedimentary basin, integrates plate motion and magmatic activities in litoshere and on surface, interpretes "how plate tectonics work and why", gives skills and knowledge for ancient plate reconstruction.					
2.32. Course content broken down in detail by weekly class schedule (syllabus)	1) Crust, mantle, core and plate structure. 2) Plate geometry and velocity. 3) Euler poles. 4) Isochrones and velocities. 5) Ridges and rifting, trenches and subduction, transform faults and fracture zones. 6) "Triple junctions" and their stability 7) Plate motion and velocity on sphere. 8) Earthquakes and plates. 9) Earthquakes at transfom faults, trenches and ridges. 10) Magnetism and isochrones, Earth,s magnetic field, rocks magnetization. 11) Reversals of the magnetic field. 12) Magnetostratigraphy. 13) Polar wandering and plate motion. 14) "What drives the plates"					
2.33. Type of instruction	X lectures ☐ seminars and workshops X exercises ☐ online in entirety ☐ mixed e-learning ☐ field work		X independent study ☐ multimedia and the internet ☐ laboratory ☐ work with the mentor ☐ (other)		2.34. Comments:	
2.35. Student responsibilities						
2.36. Screening	Class attendance		Research		Practical training	

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of student's work (specify the proportion of ECTS credits for each activity so that the total number of CTS credits is equal to the credit value of the course)*:*	Experimental work		Report			
	Essay		Seminar essay		(Other--describe)	
	Tests		Oral exam		(Other—describe)	
	Written exam		Project		(Other—describe)	
2.7. Grading and evaluation of student work over the course of instruction and at a final exam	exercises, written exam and oral exam.					

2.8. Required literature (available at the library and via other media)	**Title**	**Number of copies at the library**	**Availability via other media**
	Kearey, P., Kleipes, K. A. & Vine, F. J. (2008): Global Tectonics. Wlley-Blackwel.	**1**	
	Cox, A. & Hart, R. B. (1986): Plate Tectonics –How It Works. Blackwell Publishing.	**1**	

2.18. Optional literature (at the time of the submission of the study programme proposal)	
2.19. Methods of monitoring quality that ensure acquisition of exit competences	

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Table 3. Plan of the study programme according to the accreditation (L- lecture, S – seminar, E – exercises, F – field work)
***As needed, copy the table.**
****As needed, add rows to the table.**

COURSE STATUS	COURSE CODE	COURSE NAME	TOTAL HOURS				ECTS
			L	S	E	F	
I semester							
required	5029	Regional geology and global tectonics	60				5
	5030	Quantitative and isotope geochemistry	45		30		7
	5096	Seminar IV		30			2
		Required courses total:	105	30	30		14
elective	5038	Geohazards (compulsory)	30		15		6
	5062	Environmental mineralogy	30		15		5
	5063	Instrumental metods in environmental analysis	30		15		5

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COURSE STATUS	COURSE CODE	COURSE NAME	TOTAL HOURS				ECTS
			L	S	E	F	
II semester							
required	5031	Geostatistics	30		15		4
	5103	Field course in Geology IV				75	5
		Required courses total:	30		15	75	9
elective	5037	Environmental Geology (compulsory)	30		15		6
	5064	Hydrogeochemistry and groundwater protection	30		15		5
	5065	Geological aspects of waste disposals	30		15		5
	5066	Geochemical metodhs of environmental investigation	30		15		5
	5069	Clay mineralogy	15		30		5

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COURSE STATUS	COURSE CODE	COURSE NAME	TOTAL HOURS				ECTS
			L	S	E	F	
III semester							
required	5032	Elements of scientific work	30		15		5
	5097	Seminar V		45			3
	5104	Field project		105			12
		Required courses total:	30	150	15		20
elective	5067	Environmental geochemistry	30		15		5
	5068	Environmental law	30		15		5

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COURSE STATUS	COURSE CODE	COURSE NAME	TOTAL HOURS				ECTS
			L	S	E	F	
IV semester							
required	5105	Seminar					5
	5106	Thesis					20
		Required courses total:					25
elective	5070	Organic geochemistry of pollutants	30		15		5
	5071	Basics of pedology	30		15		5
	5073	Biogeochemistry	30		15		5
	5072	Introdaction to geotechnology	30		15		5

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Table 4. Plan of the study programme with changes and additions (L—lecture, S – seminar, E – Exercises, F – field work)
***As needed, copy the table.**
****As needed, add rows to the table.**

COURSE STATUS	COURSE CODE	COURSE NAME	TOTAL HOURS				ECTS
			L	S	E	F	
I semester							
required	71938	Plate tectonics	30				3
	71939	Geology of Croatia	30				2
	44008	Quantitative and isotopic geochemistry	45		30		7
	44011	Seminar IV			30		2
		Required courses total:	105		60		14
elective	44088	Geohazards (compulsory)	30		15		6
	44102	Environmental mineralogy	30		15		5
	44103	Instrumental metods in environmental analysis	30		15		5

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COURSE STATUS	COURSE CODE	COURSE NAME	TOTAL HOURS				ECTS
			L	S	E	F	
II semester							
required	44013	Geostatistics	30		15		4
	44018	Field course in geology IV				75	5
		Required courses total:	30		15	75	9
elective	44087	Environmental Geology (compulsory)	30		15		6
	44117	Hydrogeochemistry and groundwater protection	30		15		5
	71941	Zooarcheology	30				5
	44116	Geochemical metodhs of environmental investigation	30		15		5
	44119	Clay mineralogy	15		30		5

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COURSE STATUS	COURSE CODE	COURSE NAME	TOTAL HOURS				ECTS
			L	S	E	F	
III semester							
required	44021	Elementi znanstvenog rada	30		15		5
	44028	Seminar V		45			3
	44031	Individual Field project			105		12
		Required courses total:	30	45	120		20
elective	44104	Environmental geochemistry	30		15		5
	44105	Environmental law	30		15		5
	44115	Geological aspects of waste disposals	30		15		5

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COURSE STATUS	COURSE CODE	COURSE NAME	TOTAL HOURS				ECTS
			L	S	E	F	
IV semester							
required	44034	Seminar					5
	44037	Thesis					20
		Required courses total:					25
elective	44120	Organic geochemistry of pollutants	30		15		5
	44121	Basics of pedology	30		15		5
	44122	Biogeochemistry	30		15		5
	44118	Introdaction to geotechnology	30		15		5
	71940	Methods of remote sensing in geology	30		15		5