University of Zagreb

University of Science
DEPARTMENT OF GEOLOGY
Horvatovac 102B
10 000 Zagreb

UNIVERSITY UNDERGRADUATE STUDY OF GEOLOGY

University of Zagreb

INTRODUCTION

The undergraduate study of Geology is a three-year study carried out by the Faculty of Science, University of Zagreb, at the Department of Geology. Upon completion of the study, 180 ECTS are acquired, and the study ends with the preparation and defense of Bachelor Thesis.

Upon completion of the undergraduate study, the bachelor acquires the ability to perform tasks that cover assistance and technical activities in scientific, professional and educational institutions, public administration, economy and public sector, nature parks, national parks, etc. These are technical tasks related to research in geology and other scientific branches of science and to improve the practical application of research results. These include: preparation of materials and equipment for laboratory and field research and analysis, collection and preparation of samples in the field and in the laboratory, testing and analysis in the field and in the laboratory, computer processing and classification of data, assistance to specialized experts, providing logistical support for scientific research and research projects tasks, application of scientific achievements in solving problems in work, maintenance of research equipment, etc.

Based on many years of experience in working with students at the university undergraduate study in Geology, the need to systematize and optimize the learning outcomes of the existing study program was observed. In addition, it is necessary to improve certain courses, as well as to introduce new courses with new, more modern and necessary knowledge for students. The attached documentation for major changes to the study program was therefore prepared with the purpose of systematizing the existing learning outcomes and modernizing the studies in accordance with the latest scientific knowledge. The three-year undergraduate study in Geology was introduced in 2005, and the last minor changes to the program (0%) were made in 2023.

GENERAL INFORMATION

NAME OF THE STUDY PROGRAMME:
Geology

PROVIDER OF THE STUDY PROGRAMME:
University of Zagreb Faculty of Science, Department of Geology

DURATION OF THE STUDY:
Three years.

ADMISSION REQUIREMENTS:

Entrance examination will be required for all undergraduate studies as well as for educational study, for candidates with completed secondary (high school) education.

ACADEMIC TITLE:

University Bachelor (Baccalaureus/Baccalaurea) in Geology.

GRADUATE STUDY PROGRAMMES ON WHICH STUDENTS OF THE UNIVERSITY UNDERGRADUATE STUDY OF GEOLOGY COULD CONTINUE THEIR STUDY:

After successful completion of the undergraduate study in Geology (baccalaureate), candidate is allowed to enrol into graduate studies of Geology (Geology and Palaeontology, and Mineralogy and Petrology), Environmental geology, or Geoarhaeology, as well as into graduate studies in related disciplines (depending on admission requirements).

LEARNING OUTCOMES OF THE UNIVERSITY UNDERGRADUATE STUDY OF GEOLOGY

1) Recognise and apply basic and specific knowledge related to the fundamental laws of natural science in the interpretation of geological processes.
2) Identify basic geological processes and geological materials, and connect them with the development of life on Earth and Earth itself.
3) Identify simple geological problems and suggest possible solutions.
4) Select and use suitable geological methods and specific technologies in solving geological problems.
5) Apply information technologies (IT) when processing and presenting data.
6) Perform relevant experiments and analyses independently or in a group and present data using suitable qualitative and quantitative methods.
7) Use geological maps, domestic and foreign literature and databases, as well as other sources of information.
8) Conduct field research independently or in a group and collect, describe and classify geological samples.
9) Independently analyse geological samples in the laboratory, write and present results of research.
10) Identify problems related to sampling and data processing in field and laboratory research.
11) Organise field and laboratory data and compare them with acquired professional knowledge.
12) Communicate and discuss ideas and solutions of geological problems with colleagues and experts.
13) Design and generate simple geological models.
14) Recognise the role of geology in knowledge development, valuation of goods, spatial arrangement, improvement of life quality and environmental preservation.
15) Plan further professional development on the basis of acquired geological knowledge and developed specific skills.

University of Zagreb

ORDER OF LECTURES FOR ACADEMIC YEAR 2022/2023

I. GODINA						
I. semestar			Zimski semestar		Ljetni semestar	
Nastavnici	ISVU šifra	Obvezni predmeti	P+V+S	ECTS	P+V+S	ECTS
D. Ilišević B. Muha	255007	Matematika I	2+2+0	4		
M. Đaković	36206	Kemija I	2+2+0	5		
N. Tomašić	36199	Opća mineralogija	3+3+0	7		
B. Cvetko Tešović	36200	Fizička geologija	3+3+0	7		
V. Cosović K. Fio Firi	36201	Opća paleontologija	3+3+0	7		
K. Fučkar Reichel J. Vulić	38079	Tjelesna i zdravstvena kultura 1*	0+2+0			
II. semestar			P+V+S	ECTS	P+V+S	ECTS
D. Ilišević	255016	Matematika II			2+2+0	4
M. Đaković	36207	Kemija II			2+2+0	5
D. Paar	36208	Fizika			3+2+0	6
A. Čobić	36213	Sistematska mineralogija			3+3+0	7
T. Dražina	36209	Osnove biologije			2+1+0	3
B. Cvetko Tešović D. Kurtanjek M. Martinuš	36210	Terenska nastava iz geologije I (60 sati/god.)				5
K. Fučkar Reichel J. Vulić	38080	Tjelesna i zdravstvena kultura 2*			0+2+0	
		UKUPNO:	26	30	22	30

P = broj sati predavanja tjedno, **V** = broj sati vježbi (praktikuma) tjedno, **S** = broj sati seminara tjedno.

* U skladu sa Statutom Sveučilišta u Zagrebu, nastava Tjelesne i zdravstvene kulture obavezna je za studente I. i II. godine prijediplomskog studija, ali ne ulazi u satnicu niti joj se pripisuju ECTS bodovi.

II. GODINA						
III. semestar			Zimski semestar		Ljetni semestar	
Nastavnici	ISVU šifra	Obvezni predmeti	P+V+S	ECTS	P+V+S	ECTS
D. Bucković	41025	Historijska geologija I	3+2+0	6		
F. Marković	41026	Mineralna optika	2+4+0	5		
Đ. Pezelj	90435	Paleontologija beskralježnjaka	2+1+0	4		
V. Ćosović	41035	Mikropaleontologija I	1+2+0	3		

S. Markušić	41028	Geofizika	2+1+0	5		
G. Medunić H. Fajković	41029	Osnove elementne i fazne analize	2+2+0	5		
	41030	Seminar I	0+0+2	2		
K. Fučkar Reichel J. Vulić	40849	Tjelesna i zdravstvena kultura 3*	0+2+0			
IV. semestar			**P+V+S**	**ECTS**	**P+V+S**	**ECTS**
D. Bucković	41031	Historijska geologija II			2+2+0	4
D. Balen	41032	Petrologija magmatskih i metamorfnih stijena			3+3+0	7
M. Kovačić F. Marković	41033	Petrologija sedimenata			3+3+0	7
A. Mezga	90436	Paleontologija kralježnjaka			2+1+0	3
	41036	Seminar II			0+0+1	2
D. Balen D. Bucković M. Kovačić D. Kurtanjek	41037	Terenska nastava iz geologije II (90 sati/god.)				7
K. Fučkar Reichel J. Vulić	40850	Tjelesna i zdravstvena kultura 4*			0+2+0	
		UKUPNO:	**26**	**30**	**20**	**30**

P = broj sati predavanja tjedno, **V** = broj sati vježbi (praktikuma) tjedno, **S** = broj sati seminara tjedno.

*U skladu sa Statutom Sveučilišta u Zagrebu, nastava Tjelesne i zdravstvene kulture obavezna je za studente I. i II. godine prijediplomskog studija, ali ne ulazi u satnicu niti joj se pripisuju ECTS bodovi.

III. GODINA						
V. semestar			**Zimski semestar**		**Ljetni semestar**	
Nastavnici	**ISVU šifra**	**Obvezni predmeti**	**P+V+S**	**ECTS**	**P+V+S**	**ECTS**
B. Lužar-Oberiter	63318	Geološko kartiranje I	1+6+0	6		
B. Matoš	63320	Strukturna geologija i tektonika	2+2+0	5		
B. Lužar-Oberiter	63321	Računalni programi u geologiji	2+2+0	5		
H. Fajković	41041	Geokemija	2+1+0	4		
Z. Kovač	41042	Hidrogeologija	2+1+0	4		
vidi tablicu		Izborni predmet		4		
B. Lužar-Oberiter	63322	Terenska nastava iz geologije IIIA (30 sati/god.)		2		
VI. semestar			**P+V+S**	**ECTS**	**P+V+S**	**ECTS**
B. Lužar-Oberiter	63319	Geološko kartiranje II			1+2+0	3
D. Balen A. Čobić	41043	Geologija mineralnih ležišta			3+1+0	5

M. Krkač	41044	Inženjerska geologija			2+1+0	4
K. Gobo	71835	Analiza i interpretacija facijesa			3+2+0	5
vidi tablicu		Izborni predmet				4
	41046	Seminar III			0+0+2	2
A. Čobić K. Gobo Z. Kovač B. Lužar-Oberiter	63323	Terenska nastava iz geologije IIIB (105 sati/god.)				7
		UKUPNO:	**21#**	**30**	**17#**	**30**

#Bez satnice izbornih predmeta

Izborni predmeti			**Zimski semestar**		**Ljetni semestar**	
Nastavnici	**ISVU šifra**	**Naziv predmeta**	**P+V+S**	**ECTS**	**P+V+S**	**ECTS**
V. Ćosović	63324	Metode paleontoloških istraživanja	1+2+0	4		
A. Čobić	63325	Gemologija	2+1+0	4		
K. Pikelj I. Felja	63327	Geologija mora [1]	2+2+0	4		
Z. Petrinec	63328	Mikrofiziografija stijena			0+3+0	4
A. Mezga	63329	Geologija kvartara			2+0+0	4
F. Marković	63330	Teodolitna određivanja minerala			1+2+0	4

[1] Svaki od nositelja izvodi nastavu svake druge godine. U ak. god. 2023./2024. nastavu iz Geologije mora izvodi izv. prof. dr. sc. Kristina Pikelj

V. semestar						
Izborni predmet izvan obvezne jezgre studija			**Zimski semestar**		**Ljetni semestar**	
Nastavnici	**ISVU šifra**	**Naziv predmeta**	**P+V+S**	**ECTS**	**P+V+S**	**ECTS**
K. Fio Firi H. Fajković	213517	Stručna praksa	0+6+0	4	0+6+0	4

University of Zagreb

FORM 7 Evaluation of university study programmes of undergraduate, graduate and integrated undergraduate and graduate studies, and vocational studies

DESCRIPTION OF AMENDMENTS AND MODIFICATIONS TO UNDERGRADUATE, GRADUATE AND INTEGRATED UNDERGRADUATE AND GRADUATE STUDY PROGRAMMES

1. GENERAL INFORMATION ON THE STUDY PROGRAMME				
1. Name of the study programme	Geology			
2. Provider of the study programme	University of Zagreb Faculty of Science			
3. Partner institutions				
4. Type of study programme	Vocational study programme ☐		University study programme ☒	
5. Level of study programme	Undergraduate ☒	Graduate ☐	Integrated ☐	Postgraduate specialist ☐
6. Delivery mode	Traditional ☒	Mixed (traditional + online) ☐	Online in entirety ☐	
6.1. Is it a?	☒ single major ☐ double major ☐ interdisciplinary study programme ☐ multidisciplinary study programme ☐ developing programme ☐ joint study programme			
7. Academic/vocational degree awarded on completion of the study programme	University Bachelor (Baccalaureus/Baccalaurea) in Geology			
8. Total number of ECTS credits	Before the modification	180	After the modification	180
9. Decision of the Faculty Council on the adoption of amendments and modifications (submit in attachment)				
10. Copy of the licence for the study programme (submit in attachment)				
11. Scope of amendments and modifications to the study programme	Number of ECTS credits of the unchanged part of the programme:	116		
	Number of ECTS credits of the changed part of the programme:	64		
12. Estimate on the percentage of amendments and modifications to the study programme	Less than 20% ☐ More than 20% and less than 40% ☒ More than 40% ☐			
13. Scientific/artistic field/area of the proposed study programme	Area of Natural Sciences, Field of Geology			
14. Date of re-accreditation	January 17, 2022			
15. Number of amendments and modifications after the re-accreditation	1st			

DESCRIPTION OF AMENDMENTS AND MODIFICATIONS TO UNDERGRADUATE, GRADUATE AND INTEGRATED UNDERGRADUATE AND GRADUATE STUDY PROGRAMMES

Content*:

* **The order of Tables 2A and 2B corresponds to the order of courses from I to VI semester.**

DESCRIPTION OF AMENDMENTS AND MODIFICATIONS TO UNDERGRADUATE, GRADUATE AND INTEGRATED UNDERGRADUATE AND GRADUATE STUDY PROGRAMMES

Table 1 Description of the amendments and modifications to the study programme

What changes/additions are made Title of the course	Number of ECTS before the modification	Number of ECTS after the modification	Number of ECTS credits of the course being modified (e.g. 0, -3, +2, -1, etc.)	Explanation for the modification (e.g. deleted course, added course, replaced course, new elective/required, etc. – do not indicate the improvement of instruction)	
				Before the modification	After the modification
General Paleontology	7	6	-1	Mandatory course in I semester	Transferred to II semester as mandatory course. Number of ECTS credits being modified.
English Language I	0	3	+3		New mandatory course in I semester
System of Mineralogy	7	6	-1	Mandatory course in II semester	Number of ECTS credits being modified
Fundamentals of Biology	3	4	+1	Mandatory course in II semester	Transferred to I semester as mandatory course. Number of ECTS credits being modified.
Field course in Geology I	5	3	-2	Mandatory course in II semester	Number of ECTS credits being modified
Historical Geology I	6	5	-1	Mandatory course in III semester	Number of ECTS credits being modified
Mineral Optics	6	5	-1	Mandatory course in III semester	Number of ECTS credits being modified
Micropaleontology I	3	4	+1	Mandatory course in III semester	Number of ECTS credits being modified. Changing the name of the course from Micropaleontology I to Micropaleontology.
Geophysics	5	4	-1	Mandatory course in III semester	Transferred to u IV semester as mandatory course. Number of ECTS credits being modified.
Principles of Elemental and Phase Analysis	5	5	0	Mandatory course in III semester	Transferred to u V semester as mandatory course

DESCRIPTION OF AMENDMENTS AND MODIFICATIONS TO UNDERGRADUATE, GRADUATE AND INTEGRATED UNDERGRADUATE AND GRADUATE STUDY PROGRAMMES

Seminar I	2	0	-2	Mandatory course in III semester	Deleted course
English Language II	0	3	+3		New elective course in III and V semesters
Basics of Scientific Work	0	3	+3		New elective course in III and V semesters
Historical Geology II	4	5	+1	Mandatory course in IV semester	Number of ECTS credits being modified
Igneous and Metamorphic Petrology	7	8	+1	Mandatory course in IV semester	Replaced course by two mandatory courses: Igneous Petrology in III semester and Metamorphic Petrology in IV semester
Sedimentary Petrology	7	5	-2	Mandatory course in IV semester	Number of ECTS credits being modified
Vertebrate Paleontology	3	4	+1	Mandatory course in IV semester	Number of ECTS credits being modified
Seminar II	2	3	+1	Mandatory course in IV semester	Modified to elective course in IV semester. Number of ECTS credits being modified. Changing the name of the course from Seminar II to Seminar.
Field course in Geology II	7	5	-2	Mandatory course in IV semester	Number of ECTS credits being modified
Basics of Geomorphology	0	3	+3	Mandatory course in V semester	New elective course in IV and VI semesters
Geological Mapping I	6	5	-1	Mandatory course in V semester	Number of ECTS credits being modified. Changing the name of the course from Geological Mapping I to Geological Mapping.
Software in Geology	5	5	0	Mandatory course in V semester	Modified to elective course in V semester. Changing the name of the course from Software in Geology to Introduction to geographic information systems.
Geochemistry	4	4	0	Mandatory course in V semester	Transferred to III semester as mandatory course
Hydrogeology	4	3	-1	Mandatory course in V semester	Transferred to VI semester as elective course.

DESCRIPTION OF AMENDMENTS AND MODIFICATIONS TO UNDERGRADUATE, GRADUATE AND INTEGRATED UNDERGRADUATE AND GRADUATE STUDY PROGRAMMES

					Number of ECTS credits being modified.
Field course in Geology IIIA	2	2	0	Mandatory course in V semester	Transferred to VI semester as mandatory course
Methods in Paleontology	4	3	-1	Elective course in V semester	Number of ECTS credits being modified
Gemmology	4	0	-4	Elective course in V semester	Deleted course
Marine Geology	4	4	0	Elective course in V semester	Modified to mandatory course in V semester
Mineral Raw Materials	0	3	+3		New elective course in V semester
Environmental Geochemistry	0	3	+3		New elective course in V semester
Geological Mapping II	3	0	-3	Mandatory course in VI semester	Deleted course
Analysis and interpretation of facies	5	5	0	Mandatory course in VI semester	Changing the name of the course from Analysis and interpretation of facies to Sedimentary facies analysis
Seminar III (Final Seminar)	2	4	+2	Mandatory course in VI semester	Number of ECTS credits being modified. Changing the name of the course from Seminar III (Final Seminar) to Bachelor Thesis.
Engineering Geology	4	4	0	Mandatory course in VI semester	Modified to elective course in VI semester. Changing the name of the course from Engineering Geology to Principles of Engineering Geology.
Field course in Geology IIIB	7	4	-3	Mandatory course in VI semester	Divided into two courses: mandatory course Field course in Geology IIIB in VI semester and elective Field course in Geology IIIC in VI semester
Rock Microstructure	4	0	-4	Elective course in VI semester	Deleted course
Quaternary Geology	4	3	-1	Elective course in VI semester	Number of ECTS credits being modified
Universal Stage Methods	4	0	-4	Elective course in VI semester	Deleted course
Software in Geology	0	3	+3		New elective course in VI semester

DESCRIPTION OF AMENDMENTS AND MODIFICATIONS TO UNDERGRADUATE, GRADUATE AND INTEGRATED UNDERGRADUATE AND GRADUATE STUDY PROGRAMMES

Table 2B Description of the course that was amended and/or modified – Mathematics I

1. COURSE DECRIPTION – GENERAL INFORMATION		
	Before the modification	**After the modification**
1.1. Course teacher	Full Professor Dijana Ilišević, PhD	Full Professor Dijana Ilišević, PhD
1.2. Name of the course	Mathematics I	Mathematics I
1.3. Associate teachers		**Mateo Tomašević, Mag. Math.**
1.4. Study programme (undergraduate, graduate, integrated)	Undergraduate	Undergraduate
1.5. Status of the course	Mandatory	Mandatory
1.6. Year of the study	1st	1st
1.7. ECTS credits	4	4
1.8. Type of instruction (number of hours L + E + S + e-learning)	30 + 30 + 0 + 0	30 + 30 + 0 + 0
1.9. Expected enrolment in the course	36	36
1.10. Level of application of e-learning (level 1, 2, 3), percentage of online instruction (max. 20%)	Level 1, 0 %	Level 1, 0 %
2. COURSE DESCRIPTION		
2.1. Course objectives	Mastering solving of systems of linear equations, introducing matrices and using these tools to study elementary properties of vectors in three-dimensional space.	**To acquire an overview of the basic terms related to numbers and elementary functions and the basics of differential and integral calculus.**
2.2. Course enrolment requirements and/or entry competences required for the course	There are no special requirements and competences. The input competencies required for the course are independence and responsibility.	There are no special requirements and competences. The input competencies required for the course are independence and responsibility.
2.3. Learning outcomes at the level of the programme to which the course contributes	GL_1: Basic knowledge and understanding of natural sciences (physics, chemistry, biology, mathematics) essential for the study of geology.	**1) Recognize and apply basic and specific knowledge related to basic laws in natural sciences in the interpretation of geological processes.** **3) Formulate and test a hypothesis when solving complex geological problems.** **5) Identify, analyse and solve complex geological problems.**

DESCRIPTION OF AMENDMENTS AND MODIFICATIONS TO UNDERGRADUATE, GRADUATE AND INTEGRATED UNDERGRADUATE AND GRADUATE STUDY PROGRAMMES

		13) Design and create complex geological models.
2.4. Expected learning outcomes at the level of the course (3-10 learning outcomes)	Apply matrix calculus. Solve the system of linear equations. Calculate eigenvalues and eigenvectors of a linear operator. Calculate and apply scalar, vector and mixed products of vectors.	**1) Determine the natural domain and the inverse of the function.** **2) Calculate simpler limits.** **3) Differentiate products, quotients, compositions of elementary functions.** **4) Analyse graphs of functions using differential calculus.** **5) Understanding the logarithmic scale.**
2.5. Course content (syllabus)	Matrix algebra. The term matrix. Addition of matrices. Multiplication of a matrix by a scalar. Multiplication of matrices. Regular matrices. Some special matrices. Application. Determinants. Introduction. Determinants of order 1 and 2. Concept of permutation and definition of determinant of arbitrary order. Properties. Laplace expansion. Application of determinants to systems of linear equations. Systems of linear equations. Matrix representation. The concept of solution. Equivalent systems. Elementary transformations. Matrix rank. Gauss method of elimination. Vector spaces. Introduction. Linear combination. Linear independence. Base and dimension. Examples of vector spaces. Application to matrices. Products. Scalar product. Orthogonality. Examples of application. Vector product. Definition and application. Mixed product. Application to volume calculation.	**1) Sets. Functions. Domain and codomain** **2-3) Overview of elementary functions** **4) Sequences** **5) Limits and continuity** **6) Notion of derivation, tangent and velocity** **7) Convexity and concavity** **8) Studying the function flow** **9) Sketching a function graph** **10) Optimisation problems; minima and maxima** **11) Discrete models of the population growth** **12) Calculating of areas and volumes; the notion of integral** **13) Integration of elementary functions** **14) Basic integration techniques** **15) Modelling with logarithms**
2.6. Format of instruction:	☒ lectures ☐ seminars and workshops ☒ exercises ☐ online in entirety ☐ partial e-learning ☐ field work ☐ independent assignments ☐ multimedia and the internet ☐ laboratory ☐ work with mentor ☐ (other)	☒ lectures ☐ seminars and workshops ☒ exercises ☐ online in entirety ☐ partial e-learning ☐ field work ☐ independent assignments ☐ multimedia and the internet ☐ laboratory ☐ work with mentor ☐ (other)
2.7. Comments:		
2.8. Student obligations	Attending classes and taking exams.	Attending classes and taking exams.

2.9. Monitoring student work									
	Class attendance	YES		Research		NO	Oral exam	YES	
	Experimental work		NO	Report		NO	(other)		NO

Class attendance	YES	NO	Research		NO	Oral exam	YES	
Experimental work		NO	Report		NO	(other)		NO

DESCRIPTION OF AMENDMENTS AND MODIFICATIONS TO UNDERGRADUATE, GRADUATE AND INTEGRATED UNDERGRADUATE AND GRADUATE STUDY PROGRAMMES

	Essay		NO	Seminar paper		NO	(other)		NO	Essay		NO	Seminar paper		NO	(other)		NO
	Preliminary exam	YES		Practical work		NO	(other)		NO	Preliminary exam	YES		Practical work		NO	(other)		NO
	Project		NO	Written exam	YES		ECTS (total)	4		Project		NO	Written exam	YES		ECTS (total)	4	

	Title	**Number of copies in the library**	**Availability via other media**	**Title**	**Number of copies in the library**	**Availability via other media**
2.10. Required literature (available in the library and/or via other media)	Lipschutz, S., Lipson, M. (2001): *Schaum's Outline of Linear Algebra,* McGraw-Hill.	YES	NO	**Kurepa, S. (1975): *Matematička analiza 1*, Školska knjiga**	**YES**	**NO**
	Ferguson, J. (1994): *Introduction to Linear Algebra in Geology,* Springer Verlag.	YES	NO	**Kurepa, S. (1984): *Uvod u matematiku*, Tehnička knjiga**	**YES**	**NO**
	Elezović, N. (1995): *Linearna algebra,* Element.	YES	NO	**Demidovič, B.P. (1978): *Zadaci i riješeni primjeri iz više matematike*, Tehnička knjiga, Zagreb**	**YES**	**NO**
				Mendelson, E., Ayres, F. (2001): *Schaum's Outline of Calculus,* McGraw-Hill	**YES**	**NO**
				Javor, P. (1999): *Matematička analiza 1*, Element	**YES**	**NO**
2.11. Optional literature						

DESCRIPTION OF AMENDMENTS AND MODIFICATIONS TO UNDERGRADUATE, GRADUATE AND INTEGRATED UNDERGRADUATE AND GRADUATE STUDY PROGRAMMES

Table 2B Description of the course that was amended and/or modified – Chemistry I

1. COURSE DECRIPTION – GENERAL INFORMATION		
	Before the modification	**After the modification**
1.1. Course teacher	Full Professor Marijana Đaković, PhD	Full Professor Marijana Đaković, PhD
1.2. Name of the course	Chemistry I	Chemistry I
1.3. Associate teachers	Mateja Pisačić, PhD	Mateja Pisačić, PhD
1.4. Study programme (undergraduate, graduate, integrated)	Undergraduate	Undergraduate
1.5. Status of the course	Mandatory	Mandatory
1.6. Year of the study	1st	1st
1.7. ECTS credits	5	5
1.8. Type of instruction (number of hours L + E + S + e-learning)	30 + 30 + 0 + 0	30 + 30 + 0 + 0
1.9. Expected enrolment in the course	35	35
1.10. Level of application of e-learning (level 1, 2, 3), percentage of online instruction (max. 20%)	Level 1, 5 %	Level 1, 5 %
2.1. Course objectives	The objective of the Chemistry I course is to synthesize basic chemical concepts about the properties of substances at the macroscopic, particle (atomic-molecular) and symbolic levels, and to integrate existing and new knowledge into conceptual units.	The objective of the Chemistry I course is to synthesize basic chemical concepts about the properties of substances at the macroscopic, particle (atomic-molecular) and symbolic levels, and to integrate existing and new knowledge into conceptual units.
2.2. Course enrolment requirements and/or entry competences required for the course		
2.3. Learning outcomes at the level of the programme to which	1) Basic knowledge and understanding of the natural sciences (Physics, Chemistry, Biology, Mathematics) underlying the study of Geology	**1) Recognise and apply basic and specific knowledge related to the fundamental laws of natural science in the interpretation of geological processes.**

DESCRIPTION OF AMENDMENTS AND MODIFICATIONS TO UNDERGRADUATE, GRADUATE AND INTEGRATED UNDERGRADUATE AND GRADUATE STUDY PROGRAMMES

the course contributes	2) Awareness and understanding of the temporal and spatial dimensions in Earth processes 3) Knowledge and understanding of the complex nature of interactions within the geosphere 4) Understanding the need of a rational use of earth resources 5) Basic ability to describe a solution at an abstract level 6) Ability to integrate field and laboratory evidence with theory following the sequence from observation to recognition, synthesis and modelling 7) Ability to receive and respond to a variety of information sources (e.g. textual, numerical, verbal, graphical) 8) Ability to conduct appropriate experiments, to analyse and interpret data and draw conclusions 9) Ability to use spreadsheet and word-processing software 10) Ability to work effectively as an individual and as a member of a team 11) Ability to organise their own work independently 12) Basic ability to communicate effectively in written and verbal form with colleagues, other professionals, customers and the general public about substantive issues and problems related to their chosen specialisation	**5) Apply information technologies (IT)when processing and presenting data.** **6) Perform relevant experiments and analyses independently or in a group and present data using suitable qualitative and quantitative methods.** **10) Identify problems related to sampling and data processing in field and laboratory research.** **11) Organise field and laboratory data and compare them with acquired professional knowledge.**
2.4. Expected learning outcomes at the level of the course (3-10 learning outcomes)	1) Describe and explain the division of substances, physical and chemical properties of substances and physical and chemical changes in substances. 2) Explain the electronic structure of the atom and connect it with the chemical properties 3) Define and differentiate types of chemical bonds and types of intermolecular interactions. 4) Describe and apply the gas laws of ideal gases. 5) Know and explain the colligative properties of solutions. 6) Distinguish and explain the processes that occur in galvanic. 7) Solve simple numerical problems.	1) Describe and explain the division of substances, physical and chemical properties of substances and physical and chemical changes in substances. 2) Explain the electronic structure of the atom and connect it with the chemical properties 3) Define and differentiate types of chemical bonds and types of intermolecular interactions. 4) Describe and apply the gas laws of ideal gases. 5) Know and explain the colligative properties of solutions. 6) Distinguish and explain the processes that occur in galvanic. 7) Solve simple numerical problems.
2.5. Course content (syllabus)		**1) Substances - Properties, changes and basic chemical laws** **2) Structure of atoms; Electronic configuration** **3) Thermochemistry; Periodicity of properties of elements** **4) Ionic bond**

DESCRIPTION OF AMENDMENTS AND MODIFICATIONS TO UNDERGRADUATE, GRADUATE AND INTEGRATED UNDERGRADUATE AND GRADUATE STUDY PROGRAMMES

<table>
<tr><td></td><td colspan="8"></td><td colspan="8">5) Covalent bond
6) Metals and metal connection
7) Overview
8) Intermolecular interactions
9) Gases
10) Liquids
11) Solids
12) Properties of solutions
13) Electrochemistry
14) Acids and bases
15) Overview</td></tr>
<tr><td>2.6. Format of instruction:</td><td colspan="4">☒ lectures
☐ seminars and workshops
☒ exercises
☐ online in entirety
☐ partial e-learning
☐ field work</td><td colspan="4">☒ independent assignments
☐ multimedia and the internet
☐ laboratory
☐ work with mentor
☐ (other)</td><td colspan="4">☒ lectures
☐ seminars and workshops
☒ exercises
☐ online in entirety
☒ partial e-learning
☐ field work</td><td colspan="4">☒ independent assignments
☐ multimedia and the internet
☐ laboratory
☐ work with mentor
☐ (other)</td></tr>
<tr><td>2.7. Comments:</td><td colspan="8"></td><td colspan="8"></td></tr>
<tr><td>2.8. Student obligations</td><td colspan="8"></td><td colspan="8">Regular attendance at classes (lectures and seminars), completed homework.</td></tr>
<tr><td rowspan="5">2.9. Monitoring student work</td><td>Class attendance</td><td>YES</td><td></td><td>Research</td><td></td><td>NO</td><td>Oral exam</td><td>YES</td><td></td><td>Class attendance</td><td>YES</td><td></td><td>Research</td><td></td><td>NO</td><td>Oral exam</td><td>YES</td><td></td></tr>
<tr><td>Experimental work</td><td></td><td>NO</td><td>Report</td><td></td><td>NO</td><td>(other)</td><td></td><td>NO</td><td>Experimental work</td><td></td><td>NO</td><td>Report</td><td></td><td>NO</td><td>(other)</td><td></td><td>NO</td></tr>
<tr><td>Essay</td><td></td><td>NO</td><td>Seminar paper</td><td></td><td>NO</td><td>(other)</td><td></td><td>NO</td><td>Essay</td><td></td><td>NO</td><td>Seminar paper</td><td></td><td>NO</td><td>(other)</td><td></td><td>NO</td></tr>
<tr><td>Preliminary exam</td><td>YES</td><td></td><td>Practical work</td><td></td><td>NO</td><td>(other)</td><td></td><td>NO</td><td>Preliminary exam</td><td>YES</td><td></td><td>Practical work</td><td></td><td>NO</td><td>(other)</td><td></td><td>NO</td></tr>
<tr><td>Project</td><td></td><td>NO</td><td>Written exam</td><td>YES</td><td></td><td>ECTS (total)</td><td>5</td><td></td><td>Project</td><td></td><td>NO</td><td>Written exam</td><td>YES</td><td></td><td>ECTS (total)</td><td>5</td><td></td></tr>
<tr><td>2.10. Required literature (available in the library and/or via other media)</td><td colspan="4">Title</td><td>Number of copies in the library</td><td colspan="3">Availability via other media</td><td colspan="4">Title</td><td>Number of copies in the library</td><td colspan="3">Availability via other media</td></tr>
</table>

DESCRIPTION OF AMENDMENTS AND MODIFICATIONS TO UNDERGRADUATE, GRADUATE AND INTEGRATED UNDERGRADUATE AND GRADUATE STUDY PROGRAMMES

	Silberberg, M.S. (2009): *Chemistry, 5. izd.*, McGraw-Hill, NewYork	YES	NO	Silberberg, M.S. (2009): *Chemistry, 5. izd.*, McGraw-Hill, NewYork	YES	NO
	Sikirica, M. (2008): *Stehiometrija*, Školska knjiga, Zagreb	YES	NO	Sikirica, M. (2008): *Stehiometrija*, Školska knjiga, Zagreb	YES	NO
	Chang, R. (1991): *Chemistry, 9. izd.*, McGraw-Hill, NewYork	YES	NO	Chang, R. (1991): *Chemistry, 9. izd.*, McGraw-Hill, NewYork	YES	NO
	Filipović, I., Lipanović, S. (1991): *Opća i anorganska kemija I*, Školska knjiga, Zagreb	YES	NO	Filipović, I., Lipanović, S. (1991): *Opća i anorganska kemija I*, Školska knjiga, Zagreb	YES	NO
	Filipović, I., Lipanović, S. (1991): *Opća i anorganska kemija II*, Školska knjiga, Zagreb, 1991.	YES	NO	Filipović, I., Lipanović, S. (1991): *Opća i anorganska kemija II*, Školska knjiga, Zagreb, 1991.	YES	NO
	Grdenić D. (2006): *Molekule i kristali, 5. obnovljeno i dopunjeno izdanje*, Školska knjiga, Zagreb	YES	NO	Grdenić D. (2006): *Molekule i kristali, 5. obnovljeno i dopunjeno izdanje*, Školska knjiga, Zagreb	YES	NO
2.11. Optional literature						

DESCRIPTION OF AMENDMENTS AND MODIFICATIONS TO UNDERGRADUATE, GRADUATE AND INTEGRATED UNDERGRADUATE AND GRADUATE STUDY PROGRAMMES

Table 2B Description of the course that was amended and/or modified – Fundamentals of Biology

1. COURSE DECRIPTION – GENERAL INFORMATION		
	Before the modification	**After the modification**
1.1. Course teacher	Assistant Professor Tvrtko Dražina, PhD	Assistant Professor Tvrtko Dražina, PhD
1.2. Name of the course	Fundamentals of Biology	Fundamentals of Biology
1.3. Associate teachers	Dora Hlebec, PhD	Assistant according to the assignment schedule (exercises)
1.4. Study programme (undergraduate, graduate, integrated)	Undergraduate	Undergraduate
1.5. Status of the course	Mandatory	Mandatory
1.6. Year of the study	1st	1st
1.7. ECTS credits	3	**4**
1.8. Type of instruction (number of hours L + E + S + e-learning)	30 + 15 + 0 + 0	30 + 15 + 0 + 0
1.9. Expected enrolment in the course	36	36
1.10. Level of application of e-learning (level 1, 2, 3), percentage of online instruction (max. 20%)	Level 1, up to 3 %	Level 1, up to 3 %
2.1. Course objectives	Introducing students to basic concepts in biology, principles of evolution, and connecting biological knowledge with geology.	Introducing students to basic concepts in biology, principles of evolution, and connecting biological knowledge with geology.
2.2. Course enrolment requirements and/or entry competences required for the course		
2.3. Learning outcomes at the level of the programme to which the course contributes	1) Basic knowledge and understanding of the natural sciences (Physics, Chemistry, Biology, Mathematics) underlying the study of Geology 2) Knowledge and understanding of the essential features, processes, materials, history and the development of the Earth and life 5) An awareness of the wider spectrum of geological disciplines	**1) Recognise and apply basic and specific knowledge related to the fundamental laws of natural science in the interpretation of geological processes.** **2) Identify basic geological processes and geological materials, and connect them with the development of life on Earth and Earth itself.**

DESCRIPTION OF AMENDMENTS AND MODIFICATIONS TO UNDERGRADUATE, GRADUATE AND INTEGRATED UNDERGRADUATE AND GRADUATE STUDY PROGRAMMES

	6) Awareness and understanding of the temporal and spatial dimensions in Earth processes 9) Knowledge and understanding of the complex nature of interactions within the geosphere 10) Appropriate knowledge of other disciplines relevant to geology 13) Understanding the need of a rational use of earth resources 16) Basic ability to describe a solution at an abstract level 20) Ability to formulate and test hypotheses 25) Ability to undertake field and lab investigation in a responsible and safe manner, paying due attention to risk assessment, rights of access, relevant health and safety regulations, and sensitivity to the impact of investigation on the environment and stakeholders 33) Ability to use spreadsheet and word-processing software 35) Ability to work effectively as an individual and as a member of a team 36) Recognition of the need for, and engagement in self-managed and life-long learning	**5) Apply information technologies (IT) when processing and presenting data.** **14) Recognise the role of geology in knowledge development, valuation of goods, spatial arrangement, improvement of life quality and environmental preservation.**
2.4. Expected learning outcomes at the level of the course (3-10 learning outcomes)	1) Understanding genetic and anatomical-physiological variations of organisms based on knowledge of basic structural features of living beings. 2) Explaining the biogeography of plant and animal organisms as a result of geological changes. 3) Analysing ecological interactions as drivers of changes in the diversity and distribution of organisms. 4) Basic ability to combine theory and practical work in performing tasks where knowledge of biology is essential for interpretation in geology. 5) Ability to integrate field findings (e.g., skeletal formations, fossils) with basic principles of taxonomy through observation, recognition, and synthesis. 6) Effective ability for independent and teamwork, as well as the creation and presentation of results from material analysis in the laboratory or in the field.	1) Understanding genetic and anatomical-physiological variations of organisms based on knowledge of basic structural features of living beings. 2) Explaining the biogeography of plant and animal organisms as a result of geological changes. 3) Analysing ecological interactions as drivers of changes in the diversity and distribution of organisms. 4) Basic ability to combine theory and practical work in performing tasks where knowledge of biology is essential for interpretation in geology. 5) Ability to integrate field findings (e.g., skeletal formations, fossils) with basic principles of taxonomy through observation, recognition, and synthesis. 6) Ability for effective independent and teamwork, as well as the creation and presentation of results from material analysis in the laboratory or in the field.
2.5. Course content (syllabus)	1) Characteristics of living organisms. Exploration of the microscopic structure of living organisms.	1) Characteristics of living organisms. Investigation of the microscopic structure of living organisms.

DESCRIPTION OF AMENDMENTS AND MODIFICATIONS TO UNDERGRADUATE, GRADUATE AND INTEGRATED UNDERGRADUATE AND GRADUATE STUDY PROGRAMMES

<table>
<tr><td></td><td colspan="6">2-3) Driving factors of evolution.
4-7) Diversity of cells and molecular structure of the cell. Basic metabolic processes. Biodiversity of organisms: prokaryotes, eukaryotes.
8-13) Functional characteristics and taxonomy of prokaryotes, algae, fungi, plant, and animal life, with a focus on their role in past and recent ecosystems.
14) Basic ecological factors and principles. Ecological problems of the present era.
15) Biogeography of organisms in relation to geological and ecological changes.</td><td colspan="6">2-3) Driving factors of evolution. Microevolution. Macroevolution. Speciation.
4-7) Diversity of cells and molecular structure of the cell. Basic metabolic processes. Biodiversity of organisms: Prokaryota, Eukaryota.
8-13) Functional characteristics and taxonomy of protists, fungi, plant, and animal life, with a focus on their role in past and recent ecosystems.
14) Basic ecological factors and principles. Ecological issues of the present era.
15) Biogeography of organisms in relation to geological and ecological changes.</td></tr>
<tr><td>2.6. Format of instruction:</td><td colspan="3">☒ lectures
☐ seminars and workshops
☒ exercises
☐ online in entirety
☐ partial e-learning
☐ field work</td><td colspan="3">☒ independent assignments
☐ multimedia and the internet
☐ laboratory
☐ work with mentor
☐ (other)</td><td colspan="3">☒ lectures
☐ seminars and workshops
☒ exercises
☐ online in entirety
☐ partial e-learning
☐ field work</td><td colspan="3">☒ independent assignments
☐ multimedia and the internet
☒ laboratory
☐ work with mentor
☐ (other)</td></tr>
<tr><td>2.7. Comments:</td><td colspan="6"></td><td colspan="6">An increase in ECTS points from 3 to 4 is requested, as well as transfer of the course from II to I semester (an exchange with the course General Paleontology).</td></tr>
<tr><td>2.8. Student obligations</td><td colspan="6"></td><td colspan="6">Regular attendance of lectures and exercises and active participation in classes.</td></tr>
<tr><td>2.9. Monitoring student work</td><td colspan="6">
<table>
<tr><td>Class attendance</td><td>YES</td><td></td><td>Research</td><td></td><td>NO</td><td>Oral exam</td><td>YES</td><td></td></tr>
<tr><td>Experimental work</td><td></td><td>NO</td><td>Report</td><td>YES</td><td></td><td>(other)</td><td></td><td>NO</td></tr>
<tr><td>Essay</td><td></td><td>NO</td><td>Seminar paper</td><td></td><td>NO</td><td>(other)</td><td></td><td>NO</td></tr>
<tr><td>Preliminary exam</td><td>YES</td><td></td><td>Practical work</td><td>YES</td><td></td><td>(other)</td><td></td><td>NO</td></tr>
<tr><td>Project</td><td></td><td>NO</td><td>Written exam</td><td>YES</td><td></td><td>ECTS (total)</td><td>3</td><td></td></tr>
</table>
</td><td colspan="6">
<table>
<tr><td>Class attendance</td><td>YES</td><td></td><td>Research</td><td></td><td>NO</td><td>Oral exam</td><td>YES</td><td></td></tr>
<tr><td>Experimental work</td><td></td><td>NO</td><td>Report</td><td>YES</td><td></td><td>(other)</td><td></td><td>NO</td></tr>
<tr><td>Essay</td><td></td><td>NO</td><td>Seminar paper</td><td></td><td>NO</td><td>(other)</td><td></td><td>NO</td></tr>
<tr><td>Preliminary exam</td><td>YES</td><td></td><td>Practical work</td><td>YES</td><td></td><td>(other)</td><td></td><td>NO</td></tr>
<tr><td>Project</td><td></td><td>NO</td><td>Written exam</td><td>YES</td><td></td><td>ECTS (total)</td><td>4</td><td></td></tr>
</table>
</td></tr>
<tr><td>2.10. Required literature (available in the library</td><td colspan="3">Title</td><td>Number of copies in the library</td><td>Availability via other media</td><td colspan="3">Title</td><td>Number of copies in the library</td><td>Availability via other media</td></tr>
</table>

DESCRIPTION OF AMENDMENTS AND MODIFICATIONS TO UNDERGRADUATE, GRADUATE AND INTEGRATED UNDERGRADUATE AND GRADUATE STUDY PROGRAMMES

and/or via other media)	Campbell, N.A., Reece, J.B., Mitchell, L.G. (1999): *Biology (5th edition)*, Addison Wesley Longman Inc., New York	YES	YES	**Urry, L., Cain, M., Wasserman, S., Minorsky, P., Reece, J. (2016): *Campbell Biology, 11th Edition*, Pearson Education, New York**	**YES**	**YES**
	Kardong, K.V. (2015): *Vertebrates Comparative Anatomy, Function, Evolution*, McGraw-Hill International edition.	YES	NO	**Matoničkin, I., Klobučar, G., Kučinić, M. (2010): *Opća zoologija*, Školska knjiga, Zagreb**	**YES**	**NO**
	Levine, R.P. (1971): *GENETIKA*, Školska knjiga, Zagreb.	YES	NO			
2.11. Optional literature				**Nikolić, T. (2015): *Morfologija bilja*, Alfa, Zagreb**		

DESCRIPTION OF AMENDMENTS AND MODIFICATIONS TO UNDERGRADUATE, GRADUATE AND INTEGRATED UNDERGRADUATE AND GRADUATE STUDY PROGRAMMES

Table 2B Description of the course that was amended and/or modified – General Mineralogy

1. COURSE DECRIPTION – GENERAL INFORMATION		
	Before the modification	**After the modification**
1.1. Course teacher	Full Professor with tenure Nenad Tomašić, PhD.	Full Professor with tenure Nenad Tomašić, PhD.
1.2. Name of the course	General Mineralogy	General Mineralogy
1.3. Associate teachers	Ena Topalović, Mag. Geol.	Ena Topalović, Mag. Geol.
1.4. Study programme (undergraduate, graduate, integrated)	Undergraduate	Undergraduate
1.5. Status of the course	Mandatory	Mandatory
1.6. Year of the study	1st	1st
1.7. ECTS credits	7	7
1.8. Type of instruction (number of hours L + E + S + e-learning)	45 + 45 + 0 + 0	45 + 45 + 0 + 0
1.9. Expected enrolment in the course	30	30
1.10. Level of application of e-learning (level 1, 2, 3), percentage of online instruction (max. 20%)	Level 1, 0 %	Level 1, 0 %
2.1. Course objectives	Obtaining information about internal constitution of minerals and its correlation with mineral shape and properties, acquiring knowledge necessary for understanding later courses	**Getting familiar with basic principles in mineralogy as well as with mineralogical terminology that is important for the courses taught in the succeeding years of the study. Accomplishment of basic knowledge on internal structure of crystalline matter, and how it reflects in mineral occurrence, physical and chemical properties. Getting skilled in recognising symmetry of mineral crystals and transformation of three-dimensional properties into two-dimensional projection.**
2.2. Course enrolment requirements and/or entry competences required for the course		

DESCRIPTION OF AMENDMENTS AND MODIFICATIONS TO UNDERGRADUATE, GRADUATE AND INTEGRATED UNDERGRADUATE AND GRADUATE STUDY PROGRAMMES

2.3. Learning outcomes at the level of the programme to which the course contributes	GL_1 Basic knowledge and understanding of the natural sciences (Physics, Chemistry, Biology, Mathematics) underlying the study of Geology GL_2 Knowledge and understanding of the essential features, processes, materials, history and the development of the Earth and life GL_3 Basic knowledge and understanding of the key aspects and concepts of geology GL_4 Knowledge of the common terminology and nomenclature and the use of bibliography in Geosciences GL_5 An awareness of the wider spectrum of geological disciplines GL_6 Awareness and understanding of the temporal and spatial dimensions in Earth processes GL_7 Awareness of the applications and responsibilities of Geology and its role in society including its environmental aspects GL_9 Knowledge and understanding of the complex nature of interactions within the geosphere GL_10 Appropriate knowledge of other disciplines relevant to geology GL_12 Some understanding of the complexity of geological problems and the feasibility of their solution GL_14 Basic ability in the formalisation and specification of problems whose solution involves the use of geological methods GL_15 Knowledge of appropriate solution patterns for geological problems GL_16 Basic ability to describe a solution at an abstract level GL_17 Knowledge of the range of applications of Geology GL_18 Ability to integrate field and laboratory evidence with theory following the sequence from observation to recognition, synthesis and modelling GL_24 Basic ability to independently analyse earth materials in the field and laboratory and to describe, process, document and report the results GL_26 Basic ability to combine theory and practice to complete geological tasks	**1) Recognise and apply basic and specific knowledge related to the fundamental laws of natural science in the interpretation of geological processes.** **2) Identify basic geological processes and geological materials, and connect them with the development of life on Earth and Earth itself.** **3) Perform relevant experiments and analyses independently or in a group and present data using suitable qualitative and quantitative methods.**

DESCRIPTION OF AMENDMENTS AND MODIFICATIONS TO UNDERGRADUATE, GRADUATE AND INTEGRATED UNDERGRADUATE AND GRADUATE STUDY PROGRAMMES

	GL_27 Ability to undertake literature searches, and to use data bases and other sources of information GL_28 Ability to receive and respond to a variety of information sources (e.g. textual, numerical, verbal, graphical) GL_29 Ability to conduct appropriate experiments, to analyse and interpret data and draw conclusions GL_34 Ability to learn and study including effective time management and flexibility GL_35 Ability to work effectively as an individual and as a member of a team GL_36 Recognition of the need for, and engagement in self-managed and life-long learning GL_37 Ability to organise their own work independently GL_38 Basic ability to communicate effectively in written and verbal form with colleagues, other professionals, customers and the general public about substantive issues and problems related to their chosen specialisation	
2.4. Expected learning outcomes at the level of the course (3-10 learning outcomes)		**1) To recognize crystal forms and their symmetry properties.** **2) To identify crystal systems and classes by recognizing symmetry properties and crystal forms.** **3) To draw stereographic projection of identified symmetry elements and crystal faces.** **4) To explain connection between crystallographic properties of a mineral with its physical and chemical properties.** **5) To distinguish minerals after their physical properties.** **6) To apply symmetry operations in assessing position of structural motifs in crystal structure.** **7) To relate crystallographic and physical properties in description and identification of minerals.**
2.5. Course content (syllabus)	1) Mineral definition, three-dimensional periodicity, crystal lattice, unit cell, crystal systems 2) Morphology, symmetry elements without translation, crystal form, habit, zone	1) Mineral definition, **crystal definition**, three-dimensional periodicity, crystal lattice, unit cell, crystal systems. 2) Morphology, symmetry elements without translation, crystal form, habit, zone.

DESCRIPTION OF AMENDMENTS AND MODIFICATIONS TO UNDERGRADUATE, GRADUATE AND INTEGRATED UNDERGRADUATE AND GRADUATE STUDY PROGRAMMES

<table>
<tr><td></td><td colspan="2">3) Law of constancy of interfacial angles, spherical projection, stereographic projection, Wulff net
4) Theory of rational indices for crystal faces, notations for planes and lines, point groups (Herman-Mauguin symbols, names), general form
5) Cubic crystals forms
6) Forms in other systems, tetragonal and hexagonal system
7) Holohedral classes of orthorhombic, monoclinic and triclinic systems, problems with symmetry determinations
8) Crystal structure definition, atomic coordinates, symmetry elements with translation
9) Bravais lattices, space groups
10) Chemical bonds-crystal structure dependence, coordination number, coordination polyhedron, isomorphism, polymorphism
11) Solid solutions, exsolution, crystal defects
12) Appearance of minerals (crystals, aggregates), density, cleavage, parting, fracture, hardness, colour, streak, lustre
13) X-ray diffraction, Bragg law, Laue equations, principles of unit cell dimensions determination
14) Division of minerals on optical properties (optically isotropic and anisotropic materials), birefringence, optical indicatrix,
15) Division of optically anisotropic materials (uniaxial - biaxial, optically positive and negative), relief, colour, interference colours, extinction, observations in convergent light.</td><td colspan="2">3) Law of constancy of interfacial angles, spherical projection, stereographic projection, Wulff net.
4) Theory of rational indices for crystal faces, notations for planes and directions in crystals, point groups (Herman-Mauguin symbols, names), general form.
5) Cubic crystals forms in three crystal classes (holohedral, hemihedral).
6) Forms of tetragonal (holohedral) and hexagonal system (holohedral, rhombohedral hemihedral).
7) Holohedral classes of orthorhombic, monoclinic and triclinic systems.
8) Crystal structure definition, atomic coordinates, symmetry elements with translation.
9) Bravais lattices, space groups.
10) Crystal chemistry: Chemical bonds-crystal structure dependence, coordination number, coordination polyhedron, isomorphism, polymorphism.
11) Solid solutions, exsolution, crystal defects, twinning.
12) Physical properties of minerals: crystal habit, crystal aggregates, density/specific gravity, cleavage, parting, fracture, hardness, colour, streak, lustre, luminescence, electric and magnetic properties.
13) Methods of crystal structure determination: X-ray diffraction, Bragg law, Laue equations, principles of unit cell dimensions determination
14) Optical properties of minerals: Division of minerals on optical properties (optically isotropic and anisotropic materials), birefringence, optical indicatrix.
15) Division of optically anisotropic materials (uniaxial - biaxial, optically positive and negative), relief, colour, interference colours, extinction, observations in convergent light.</td></tr>
<tr><td>2.6. Format of instruction:</td><td>☒ lectures
☐ seminars and workshops
☒ exercises
☐ online in entirety
☐ partial e-learning
☐ field work</td><td>☐ independent assignments
☐ multimedia and the internet
☐ laboratory
☐ work with mentor</td><td>☒ lectures
☐ seminars and workshops
☒ exercises
☐ online in entirety
☐ partial e-learning
☐ field work</td><td>☐ independent assignments
☐ multimedia and the internet
☐ laboratory
☐ work with mentor</td></tr>
</table>

DESCRIPTION OF AMENDMENTS AND MODIFICATIONS TO UNDERGRADUATE, GRADUATE AND INTEGRATED UNDERGRADUATE AND GRADUATE STUDY PROGRAMMES

					☐ (other)											☐ (other)			
2.7. Comments:																			
2.8. Student obligations	Regular attendance at classes, colloquiums that, in addition to the theoretical part, also include work with crystal models, homework.									**Regular attendance of classes, positively solved colloquiums.**									
2.9. Monitoring student work	Class attendance	YES		Research		NO	Oral exam	YES		Class attendance	YES		Research		NO	Oral exam	YES	
	Experimental work		NO	Report		NO	(other)		NO	Experimental work		NO	Report		NO	(other)		NO
	Essay		NO	Seminar paper		NO	(other)		NO	Essay		NO	Seminar paper		NO	(other)		NO
	Preliminary exam	YES		Practical work		NO	(other)		NO	Preliminary exam	YES		Practical work		NO	(other)		NO
	Project		NO	Written exam	YES		ECTS (total)	7		Project		NO	Written exam	YES		ECTS (total)	7	

2.10. Required literature (available in the library and/or via other media)	**Title**	**Number of copies in the library**	**Availability via other media**	**Title**	**Number of copies in the library**	**Availability via other media**
	Klein, C. (2002): *Mineral Science*, John Wiley & Sons, Inc., New York.	YES	NO	**Slovenec, D. (2011): *Opća mineralogija,* RGNF, Zagreb.**	**YES**	**NO**
	Nesse, W.D. (2000): *Introduction to mineralogy*, Oxford University Press, Oxford.	YES	NO	Klein, C. (2002): *Mineral Science,* John Wiley & Sons, Inc., New York. Older editions e.g.: C. Klein, C.S. Hurlbut (1999): *Manual of mineralogy*	YES	NO
	Hibbard, M.J. (2002): *Mineralogy, a geologist's point of view*, McGraw_Hill, New York.	YES	NO	Nesse, W.N. (2000): *Introduction to mineralogy,* Oxford University Press, Oxford.	YES	NO
				Hibbard, M.J. (2002): *Mineralogy, a geologist's point of view,* McGraw_Hill, New York.	YES	NO
				Wenk, H.R., Bulakh, A. (2004): *Minerals, their constitution and origin,* Cambridge University Press, Cambridge.	**YES**	**NO**

DESCRIPTION OF AMENDMENTS AND MODIFICATIONS TO UNDERGRADUATE, GRADUATE AND INTEGRATED UNDERGRADUATE AND GRADUATE STUDY PROGRAMMES

2.11. Optional literature	Wenk, H.R., Bulakh, A. (2004): *Minerals, their constitution and origin,* Cambridge University Press, Cambridge.			**Borchardt Ott, W. (1995): *Crystallography,* Springer, Berlin.** **Vrkljan, M., Borojević Šoštarić, S., Tomašić, N. (2018): *Optička mineralogija: Određivanje minerala polarizacijskim mikroskopom,* RGNF_PMF, Zagreb.** **Barić, Lj., Tajder, M. (1967): *Mikrofiziografija petrogenih minerala,* Školska knjiga, Zagreb.** **Vrkljan, M., Babić, V., Takšić, J. (1998): *Mineralogija*, Školska knjiga, Zagreb.** **Tućan, F. (1951): *Opća mineralogija,* Školska knjiga, Zagreb.**		

DESCRIPTION OF AMENDMENTS AND MODIFICATIONS TO UNDERGRADUATE, GRADUATE AND INTEGRATED UNDERGRADUATE AND GRADUATE STUDY PROGRAMMES

Table 2B Description of the course that was amended and/or modified – Physical Geology

1. COURSE DECRIPTION – GENERAL INFORMATION		
	Before the modification	**After the modification**
1.1. Course teacher	Full Professor Blanka Cvetko Tešović, PhD	Full Professor Blanka Cvetko Tešović, PhD
1.2. Name of the course	Physical Geology	Physical Geology
1.3. Associate teachers	Assistant Professor Maja Martinuš, PhD Marina Čančar, Master of Geology	Assistant Professor Maja Martinuš, PhD Marina Čančar, Master of Geology
1.4. Study programme (undergraduate, graduate, integrated)	Undergraduate	Undergraduate
1.5. Status of the course	Mandatory	Mandatory
1.6. Year of the study	1st	1st
1.7. ECTS credits	7	7
1.8. Type of instruction (number of hours L + E + S + e-learning)	45 + 45 + 0 + 0	45 + 45 + 0 + 0
1.9. Expected enrolment in the course		35
1.10. Level of application of e-learning (level 1, 2, 3), percentage of online instruction (max. 20%)	Level 1, 0 %	Level 1, 0 %
2.1. Course objectives	Introduction to geology, acquainting with geological constitution of the Earth and processes in its interior, and on the surface. Study of basic rock types, tectonic processes and structures. Study of Earth's inner dynamics, earthquakes and volcanism. Acquainting with environments, their characteristics, dynamics, sediments, and geological role. Understanding the evolution of life on Earth and fossil types. Developing basic research skills in geology.	Get acquainted with the geological structure of the Earth, the processes in the Earth's interior and on the surface, with the basic types of rocks as well as with tectonic processes and structures. Understanding the Earth's internal dynamics, earthquakes and volcanism, environment on the Earth, their geological properties, dynamics and significance. Understanding the development of life on Earth and types of fossils. Mastering the basic methods of geological research.
2.2. Course enrolment requirements and/or entry competences required for the course		

DESCRIPTION OF AMENDMENTS AND MODIFICATIONS TO UNDERGRADUATE, GRADUATE AND INTEGRATED UNDERGRADUATE AND GRADUATE STUDY PROGRAMMES

2.3. Learning outcomes at the level of the programme to which the course contributes	1) Knowledge and understanding of the essential features, processes, materials, history and the development of the Earth and life. 2) Basic knowledge and understanding of the key aspects and concepts of geology 3) Knowledge of the common terminology and nomenclature and the use of bibliography in Geosciences. 4) An awareness of the wider spectrum of geological disciplines. 5) Awareness and understanding of the temporal and spatial dimensions in Earth processes. 6) Awareness of major geological paradigms, the extent of geological time and Plate Tectonics. 7) Knowledge and understanding of the complex nature of interactions within the geosphere. 8) Some understanding of the complexity of geological problems and the feasibility of their solution 9) Basic ability in the formalisation and specification of problems whose solution involves the use of geological methods 10) Knowledge of appropriate solution patterns for geological problems.	**1) Recognise and apply basic and specific knowledge related to the fundamental laws of natural science in the interpretation of geological processes.** **2) Identify basic geological processes and geological materials, and connect them with the development of life on Earth and Earth itself** **3) Identify simple geological problems and suggest possible solutions.**
2.4. Expected learning outcomes at the level of the course (3-10 learning outcomes)	Expected learning outcomes at the level of the course have not been defined	**1) Critically evaluate theories in the natural sciences about the origin of the Solar System and the Earth.** **2) Interpret the theory of plate tectonics and related geological processes (volcanism, earthquakes).** **3) To connect the basic geological processes in the Earth's interior and on the surface.** **4) Distinguish basic types of rocks, simple tectonic processes and geological structures** **5) Interpret the formation of rocks, simple tectonic processes and geological structures.** **6) Recognize and use the contents of basic and special geological maps.** **7) Differentiate and interpret the environments on Earth, their characteristics, origin, dynamics and geological significance.** **8) Connect events during the development of life on Earth.**

DESCRIPTION OF AMENDMENTS AND MODIFICATIONS TO UNDERGRADUATE, GRADUATE AND INTEGRATED UNDERGRADUATE AND GRADUATE STUDY PROGRAMMES

		9) Rank the sequence of geological events with the application of geological principles. **10) Select and apply basic methods of geological research.**
2.5. Course content (syllabus)	Relation of Geology with other natural sciences. Space, origin of the Earth, planets, asteroids, comets, meteors. Shape and constitution of the Earth. Minerals and rocks key elements of the lithosphere. Plate tectonics: boundaries, causes. Magmatism and volcanism: magmatic bodies, types of volcanic rocks, volcano types, types of volcanic eruptions and their products, calderas, post-volcanic activity. Seismics: causes of earthquakes, wave types, principles of seismograph operation, seismogram, tsunami, seiches, intensity and energy of earthquakes, MCS-scale, Richter's magnitude, earthquake effects, role of substratum on earthquake effects, post-earthquake processes, applied seismic research in geology. Tectonics: bed, bedding plane properties, bed strike and dip, geological compass, concordance and discordance, folds (components, types, systems), faults (components, types, systems), overthrusts and overthrusting mechanism. Surface processes: weathering (chemical, mechanical), origin of soils, slope processes (creep, slumping, debris flow, turbidity currents, rock-falls), transport and erosion, Hjulström's diagram, sedimentation, sedimentary structures, diagenesis. Water: hydrologic cycle, rock porosity and permeability, types of water, water table, aquifer and barrier, threats and protection of ground water, water in islands, types of springs. Rivers: drainage systems, drainage basin and divide, stream characteristics, stream graded profile, base level, river types, rivers and geological structures, flood plains, alluvial terraces, deltas (Gilbert-deltas, ordinary deltas), delta progradation, estuary (origin, types), alluvial fans and fan deltas. Lakes: types, hydrology, sediments, response to base-level change, ecological threats. Karst: genesis, geomorphology (surficial and	1) Geology in natural sciences and its application. Solar system, planet Earth and its origin, planets, asteroids, comets, meteors. The shape and structure of the Earth. 2) Plate tectonics and types of plate boundaries. **Minerals and rocks.** 3) Magmatism and volcanism: types of rocks, magmatic bodies, types of volcanoes, types of volcanic eruptions and products. 4) Seismics: causes of earthquakes, wave types, seismograph, seismogram, intensity and energy of earthquakes, MCS-scale, Richter's magnitude, earthquakes effects of, tsunamis, applied seismicity research in geology. 5) Structural elements of the lithosphere: bed, bedding plane properties, bed strike and dip, geological compass, relationship between layers, folds (components, types), faults (components, types), fault systems, overthrusts and overthrusting mechanism covers and thrust mechanism. 6) **Presentation of the geological structure of the field (geological map, geological profile, geological column).** 7) Egzodynamic (surfaces) processes: weathering (mechanical, chemical), origin of soils, slope processes, transport, sedimentation, sedimentary structure, diagenesis. 8) Water: hydrological cycle, rock porosity and permeability, types of water, water table, types of springs. Rivers: flow characteristics, equilibrium profile of the river, types of rivers, relationship to geological structures, flood plains, alluvial terraces, deltas, estuaries, alluvial fans and fan deltas. Lakes: types, hydrology, sediments. 9) Karst: genesis, geomorphology (surficial and underground features), hydrogeology of karst. 10) Ice: origin, ice properties of, types of ice on Earth, glaciers ice (structure, movement), glacial geomorphology, glacial sediments and sedimentary bodies.

	underground features), hydrogeology of karst, origin of caves, cave morphology and tectonics, response to base-level change, ecological threats, evolution of karst. Snow, avalanches, geological role of avalanches. Ice: origin of glacier ice, ice properties, types of ice cover on the Earth, glaciers (composition, movement), glacial geomorphology, glacial sediments (moraines, proglacial lake deposits) and sedimentary bodies (eskers, drumlins, glaciofluvial and glaciomarine deltas), fiords, sandar. Deserts: distribution, origin/causes, types, desert geomorphology, evolution of desert landscape, sediments and sedimentary bodies (dunes, types of dunes), draa, ergs, desert hydrogeology, oasis, wadi, desertification in Mesopotamy, water and Middle East conflicts. Seas and Oceans: volume of seas on the Earth, chemistry of sea-water, tides, sea currents, waves, wave erosion, ravinement, classification of seas, coastal types and coastal geomorphology, effects of hurricanes and storms on coastal processes, carbonate platforms, deep-sea physiography, processes and sediments in various bathymetric zones, sea-level change (relative, eustatic), types of depositional basins. Earth physics: isostasy, glacioisostasy, heat (radiation, heat flux), magnetism (cause, van Allen's radiation belts, paleomagnetism). Geological time: dating in geology (relative, radiometric), stratigraphical systems (geochronological, chronostratigraphical, lithostratigraphical). Evolution of life on the Earth: fossilisation, types of fossils, faunal turnovers in Earth history. Environments and facies.		11) Wind: erosion, transport, deposition. Deserts: distribution on the Earth, causes, types, desert geomorphology, sediments and sedimentary bodies. 12-13) Seas and oceans: relationship between sea and land, tides, sea currents, waves, wave erosion, divisions of sea spaces, types of coasts, sea physiography, processes, and sediments in various bathymetric bathymetric zones, carbonate platforms, sea-level change. 14) Earth physics: isostasy, glacioisostasy, heat flow, magnetism and palaeomagnetism. 15) Geological time (relative, radiometric). Evolution of life on the Earth.	
2.6. Format of instruction:	☒ lectures ☐ seminars and workshops ☒ exercises ☐ online in entirety ☐ partial e-learning	☐ independent assignments ☐ multimedia and the internet ☐ laboratory	☒ lectures ☐ seminars and workshops ☒ exercises ☐ online in entirety ☐ partial e-learning	☐ independent assignments ☐ multimedia and the internet ☐ laboratory

DESCRIPTION OF AMENDMENTS AND MODIFICATIONS TO UNDERGRADUATE, GRADUATE AND INTEGRATED UNDERGRADUATE AND GRADUATE STUDY PROGRAMMES

<table>
<tr><td></td><td colspan="10">☒ field work ☐ work with mentor ☐ (other)</td><td colspan="10">☒ field work ☐ work with mentor ☐ (other)</td></tr>
<tr><td>2.7. Comments:</td><td colspan="10"></td><td colspan="10"></td></tr>
<tr><td>2.8. Student obligations</td><td colspan="10">Familiarity with rock types, solving problems in tectonics, seismicity and egzodynamics. Regular Preliminary exam colloquia.</td><td colspan="10">Familiarity with rock types, solving problems in tectonics, seismicity and egzodynamics. Regular Preliminary exam colloquia.</td></tr>
<tr><td rowspan="5">2.9. Monitoring student work</td><td>Class attendance</td><td>YES</td><td></td><td>Research</td><td></td><td>NO</td><td>Oral exam</td><td>YES</td><td></td><td>Class attendance</td><td>YES</td><td></td><td>Research</td><td>YES</td><td></td><td>Oral exam</td><td>YES</td><td></td></tr>
<tr><td>Experimental work</td><td></td><td>NO</td><td>Report</td><td></td><td>NO</td><td>(other)</td><td></td><td>NO</td><td>Experimental work</td><td></td><td>NO</td><td>Report</td><td></td><td>NO</td><td>(other)</td><td></td><td>NO</td></tr>
<tr><td>Essay</td><td></td><td>NO</td><td>Seminar paper</td><td></td><td>NO</td><td>(other)</td><td></td><td>NO</td><td>Essay</td><td></td><td>NO</td><td>Seminar paper</td><td></td><td>NO</td><td>(other)</td><td></td><td>NO</td></tr>
<tr><td>Preliminary exam</td><td>YES</td><td></td><td>Practical work</td><td></td><td>NO</td><td>(other)</td><td></td><td>NO</td><td>Preliminary exam</td><td>YES</td><td></td><td>Practical work</td><td></td><td>NO</td><td>(other)</td><td></td><td>NO</td></tr>
<tr><td>Project</td><td></td><td>NO</td><td>Written exam</td><td>YES</td><td></td><td>ECTS (total)</td><td>7</td><td></td><td>Project</td><td></td><td>NO</td><td>Written exam</td><td>YES</td><td></td><td>ECTS (total)</td><td>7</td><td></td></tr>
<tr><td rowspan="4">2.10. Required literature (available in the library and/or via other media)</td><td colspan="3">Title</td><td>Number of copies in the library</td><td colspan="3">Availability via other media</td><td colspan="3">Title</td><td colspan="3">Number of copies in the library</td><td colspan="3">Availability via other media</td></tr>
<tr><td colspan="3">Murck B.W., Skinner B.J., Porter S.C. (1996): Environmental Geology, John Wiley & Sons, New York.</td><td>YES</td><td colspan="3">NO</td><td colspan="3">Herak, M. (1990): Geologija, 5. izd., Školska knjiga, Zagreb, 450 p.</td><td colspan="3">YES</td><td colspan="3">NO</td></tr>
<tr><td colspan="3">Tarbuk, E.J., Lutgens, F.K. (1988): Earth Science. 5th. Ed., Merrill Publ. Company, Columbus.</td><td>YES</td><td colspan="3">NO</td><td colspan="3">Pavelić, D. (2012): Opća geologija, Sveučilište u Zagrebu, Rudarsko-geološko-naftni fakultet, 237 p.</td><td colspan="3">YES</td><td colspan="3">NO</td></tr>
<tr><td colspan="3">Plummer, Ch.C., McGeary, D. (1991): Physical Geology, 5th. Ed., WC Brown Publishers.</td><td>YES</td><td colspan="3">NO</td><td colspan="3">Wicander, R. Monroe, S. (1999): Essentials of Geology, 8th Ed., Wasworth Publ. Company, Belmont, 447 p.</td><td colspan="3">YES</td><td colspan="3">NO</td></tr>
</table>

DESCRIPTION OF AMENDMENTS AND MODIFICATIONS TO UNDERGRADUATE, GRADUATE AND INTEGRATED UNDERGRADUATE AND GRADUATE STUDY PROGRAMMES

	Plummer, Ch.C. McGeary, D. Carlson, D. (2001): *Physical Geology, 8th Ed*., Mc Graw Hill, Boston, 580 p.	YES	NO	Plummer, Ch.C. McGeary, D. Carlson, D. (2001): *Physical Geology, 8th Ed*., Mc Graw Hill, Boston, 580 p.	YES	NO
2.11. Optional literature	Tarbuk, E.J. Lutgens, F.K. (1988): *Earth Science. 5th Ed*., Merrill Publ. Company, Columbus, 612 p. Plummer, Ch.C. McGeary, D. (1993): *Physical Geology, 6th Ed*., WC Brown Publishers			Tarbuk, E.J. Lutgens, F.K. (1988): *Earth Science. 5th Ed*., Merrill Publ. Company, Columbus, 612 p. Plummer, Ch.C. McGeary, D. (1993): *Physical Geology, 6th Ed*., WC Brown Publishers		

DESCRIPTION OF AMENDMENTS AND MODIFICATIONS TO UNDERGRADUATE, GRADUATE AND INTEGRATED UNDERGRADUATE AND GRADUATE STUDY PROGRAMMES

Table 2A Description of the new course – English Language I

1. COURSE DECRIPTION – GENERAL INFORMATION			
1.1. Course teacher	Dubravka Pleše, PhD, Senior Lecturer	1.6. Year of the study	1st
1.2. Name of the course	English language I	1.7. ECTS credits	4
1.3. Associate teachers		1.8. Type of instruction (number of hours L + S + E + e-learning)	30 + 0 + 0 + 0
1.4. Study programme (undergraduate, graduate, integrated)	Undergraduate	1.9. Expected enrolment in the course	37
1.5. Status of the course	Mandatory	1.10. Level of application of e-learning (level 1, 2, 3), percentage of online instruction (max. 20%)	Level 1

2. COURSE DESCRIPTION			
2.1. Course objectives	To understand and adopt scientific and professional terminology in the field of geology. To familiarize students with geological phenomena and explain their causes and consequences in English. To encourage students to critically reflect on geological science. To expand and build students' vocabulary in the English language of the profession, as well as develop and enhance their communication skills (both oral and written) and the ability to comprehend specialized topics.		
2.2. Enrolment requirements and/or entry competences required for the course	B2 level of English		
2.3. Learning outcomes at the level of the programme to which the course contributes	To recognize and apply fundamental and specific knowledge related to basic natural science principles in interpreting geological processes and teach students to name them in the English language. To identify basic geological processes and materials, connect them with the Earth's development and life on it, and name them in English. To utilize geological maps, professional domestic and foreign literature, databases, as well as other sources of information. To communicate and justify ideas and solutions to geological problems in English with colleagues and experts.		
2.4. Expected learning outcomes at the level of the course (3-10 learning outcomes)	Students will name geological phenomena and processes in English, provide examples of these phenomena and processes, describe the processes of the formation of individual phenomena, interpret them, connect causes and consequences, and establish and compare the similarities and differences of various processes and phenomena.		
2.5. Course content (syllabus)	1) Introductory Session / Understanding Science 2) What is Geology? 3) Important Principles of Geology 4) History of Geology 5) Earth and its Environment 6) Film Session 7) Quiz 8) Basic Equipment in the Study of Geology 9) Minerals 10) Weathering, Erosion, and Sedimentary Rocks 11) Metamorphic Rocks 12) Igneous Processes and Volcanism 13) Film Session 14) Quiz 15) Quiz Correction and Final Session		
2.6. Format of instruction:	☒ lectures ☐ seminars and workshops ☐ exercises ☐ online in entirety ☐ partial e-learning	☐ independent assignments ☐ multimedia and the internet ☐ laboratory ☐ work with mentor ☐ (other)	2.7. Comments:

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	☐ field work								
2.8. Student obligations	Attending classes.								
2.9. Monitoring student work	Class attendance	YES		Research		NO	Oral exam	YES	
	Experimental work		NO	Report		NO	(other)		NO
	Essay		NO	Seminar paper		NO	(other)		NO
	Preliminary exam	YES		Practical work		NO	(other)		NO
	Project		NO	Written exam		NO	ECTS (total)	**4**	

	Title	**Number of copies in the library**	**Availability via other media**
2.10. Required literature (available in the library and/or via other media)	Pleše, D. (2013): *Skripta iz engleskog jezika za studente geologije*	NO	YES
	Johnson, C., Affolter, M.P., Inkenbrandt, P, Mosher, P. (2017): *An Introduction to Geology*, Salt Lake Community College.	NO	YES
2.11. Optional literature (name the title)	Compton, R.R. (2016): *Geology in the Field*, Earthspun Books		

DESCRIPTION OF AMENDMENTS AND MODIFICATIONS TO UNDERGRADUATE, GRADUATE AND INTEGRATED UNDERGRADUATE AND GRADUATE STUDY PROGRAMMES

Table 2B Description of the course that was amended and/or modified – Mathematics II

1. COURSE DECRIPTION – GENERAL INFORMATION		
	Before the modification	**After the modification**
1.1. Course teacher	Full Professor Dijana Ilišević, PhD	Full Professor Dijana Ilišević, PhD
1.2. Name of the course	Mathematics II	Mathematics II
1.3. Associate teachers		
1.4. Study programme (undergraduate, graduate, integrated)	Undergraduate	Undergraduate
1.5. Status of the course	Mandatory	Mandatory
1.6. Year of the study	1st	1st
1.7. ECTS credits	4	4
1.8. Type of instruction (number of hours L + E + S + e-learning)	30 + 30 + 0 + 0	30 + 30 + 0 + 0
1.9. Expected enrolment in the course	36	36
1.10. Level of application of e-learning (level 1, 2, 3), percentage of online instruction (max. 20%)	Level 1, 0 %	Level 1, 0 %
2.1. Course objectives	To acquire an overview of the basic terms related to numbers and elementary functions and the basics of differential and integral calculus.	**To master solving of simpler differential equations, systems of linear equations, matrix calculus and the use of these tools to study the elementary properties of vectors in three-dimensional space.**
2.2. Course enrolment requirements and/or entry competences required for the course	Completed course Mathematics I.	Completed course Mathematics I.
2.3. Learning outcomes at the level of the programme to which the course contributes	GL_1: Basic knowledge and understanding of natural sciences (physics, chemistry, biology, mathematics) essential for the study of geology. GL_12: Basic understanding of the complexity of geological problems and the feasibility of their solutions.	**1) Recognize and apply basic and specific knowledge related to basic laws in natural sciences in the interpretation of geological processes.** **3) Formulate and test a hypothesis when solving complex geological problems.**

DESCRIPTION OF AMENDMENTS AND MODIFICATIONS TO UNDERGRADUATE, GRADUATE AND INTEGRATED UNDERGRADUATE AND GRADUATE STUDY PROGRAMMES

	GL_20: Ability to formulate and test a hypothesis.		**5) Identify, analyse and solve complex geological problems.** **13) Design and create complex geological models.**	
2.4. Expected learning outcomes at the level of the course (3-10 learning outcomes)	1) Describe the properties of elementary functions. 2) Give examples of elementary functions in natural sciences. 3) Give examples of sequences and series. 4) Apply differential and integral calculus in simpler problems.		**1) Add vectors and multiply vectors by a scalar, calculate the scalar product of vectors, determine the cross product of vectors and the mixed product of vectors. Add, multiply and determine the determinants of square matrices.** **2) Solve systems of linear equations using the Gaussian method.** **3) Use rank and determinants when examining the solvability of systems of linear equations.** **4) Study the data with linear regression analysis.** **5) Solve several basic types of differential equations.** **6) Model simpler problems with differential equations.**	
2.5. Course content (syllabus)	Sets. Basic set operations. Set N. Principle of mathematical induction. Sets Q, R and C. Functions. The concept of function. Injectivity and surjectivity. Examples of functions. Sequences. The concept o a sequence. Algebra of sequences. Limit of a sequence. Properties of convergent sequences. Monotone sequences. Some important limits. Series. The concept of series. Necessary and sufficient conditions of convergence. Convergence criteria. Properties of convergent series. Continuous functions. Definition of continuity. Properties of continuous functions. Continuity of elementary functions. Differential calculus. The concept of derivation. Differentiation rules. Basic theorems of differential calculus. Applications. Integral calculus. Primitive function. Basic properties of the indefinite integral. Integration methods. The definite integral. Applications to area and volume calculation.		**1) Vectors in three-dimensional space and corresponding operations.** **2-3) Notion of matrix; adding and multiplying matrices. Determinants.** **4-5) Systems of linear equations. Elementary transformations. Gauss elimination method.** **6-7) The rank of a matrix; matrix inverse.** **8) Linear regression analysis by the least square method.** **9) Eigenvalues and eigenvectors.** **10) Leslie model of the population growth.** **11) Ordinary differential equations. Motivation.** **12) Linear ordinary differential equation of the first order.** **13) Autonomous equations. Modelling of the population growth.** **14) Basic types of differential equations.** **15) Solving methods of linear ordinary differential equation of higher order with constant coefficients.**	
2.6. Format of instruction:	☒ lectures ☐ seminars and workshops ☒ exercises ☐ online in entirety ☐ partial e-learning ☐ field work	☐ independent assignments ☐ multimedia and the internet ☐ laboratory ☐ work with mentor ☐ (other)	☒ lectures ☐ seminars and workshops ☒ exercises ☐ online in entirety ☐ partial e-learning ☐ field work	☐ independent assignments ☐ multimedia and the internet ☐ laboratory ☐ work with mentor ☐ (other)
2.7. Comments:				

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2.8. Student obligations	Attending classes and taking exams.									Attending classes and taking exams.								
2.9. Monitoring student work	Class attendance	YES		Research		NO	Oral exam	YES	NO	Class attendance	YES		Research		NO	Oral exam	YES	
	Experimental work		NO	Report		NO	(other)		NO	Experimental work		NO	Report		NO	(other)		NO
	Essay		NO	Seminar paper		NO	(other)		NO	Essay		NO	Seminar paper		NO	(other)		NO
	Preliminary exam	YES		Practical work		NO	(other)		NO	Preliminary exam	YES		Practical work		NO	(other)		NO
	Project		NO	Written exam	YES		ECTS (total)	4		Project		NO	Written exam	YES		ECTS (total)	4	

	Title	**Number of copies in the library**	**Availability via other media**	**Title**	**Number of copies in the library**	**Availability via other media**
2.10. Required literature (available in the library and/or via other media)	Mendelson, E., Ayres, F. (2001): *Schaum's Outline of Calculus,* McGraw-Hill.	YES	NO	**Kurepa, S. (1975): *Matematička analiza 1*, Školska knjiga**	**YES**	**NO**
	Javor, P. (1999): *Matematička analiza 1*, Element.	YES	NO	**Kurepa, S. (1984): *Uvod u matematiku*, Tehnička knjiga**	**YES**	**NO**
				Demidovič, B.P. (1978): *Zadaci i riješeni primjeri iz više matematike*, Tehnička knjiga, Zagreb, 1978.	**YES**	**NO**
				Lipschutz, S. Lipson, M. (2001): *Schaum's Outline of Linear Algebra*, McGraw-Hill	**YES**	**NO**
				Elezović, N. (1995): *Linearna algebra*, Element	**YES**	**NO**
				Ferguson, J. (1994): *Introduction to Linear Algebra in Geology*, Springer Verlag	**YES**	**NO**
2.11. Optional literature				**Boyce, W.E., DiPrima, R.C. (2004): *Elementary differential equations*, New York, Wiley & Sons**		

DESCRIPTION OF AMENDMENTS AND MODIFICATIONS TO UNDERGRADUATE, GRADUATE AND INTEGRATED UNDERGRADUATE AND GRADUATE STUDY PROGRAMMES

Table 2B Description of the course that was amended and/or modified – Chemistry II

1. COURSE DECRIPTION – GENERAL INFORMATION		
	Before the modification	**After the modification**
1.1. Course teacher	Full Professor Marijana Đaković, PhD	Full Professor Marijana Đaković, PhD
1.2. Name of the course	Chemistry II	Chemistry II
1.3. Associate teachers	Mateja Pisačić, PhD Mladen Borovina, PhD Full Professor with tenure Biserka Prugovečki, PhD Nikola Bedeković, PhD	Mateja Pisačić, PhD Mladen Borovina, PhD Full Professor with tenure Biserka Prugovečki, PhD Nikola Bedeković, PhD
1.4. Study programme (undergraduate, graduate, integrated)	Undergraduate	Undergraduate
1.5. Status of the course	Mandatory	Mandatory
1.6. Year of the study	2nd	2nd
1.7. ECTS credits	5	5
1.8. Type of instruction (number of hours L + E + S + e-learning)	30 + 30 + 0 + 0	30 + 0 + 30 + 0
1.9. Expected enrolment in the course	35	35
1.10. Level of application of e-learning (level 1, 2, 3), percentage of online instruction (max. 20%)	Level 1	Level 1, **5 %**
2.1. Course objectives	The objective of the Chemistry II course is to synthesize basic chemical concepts about the properties of substances at the macroscopic, particle (atomic-molecular) and symbolic levels and to integrate existing and new knowledge into conceptual units.	The objective of the Chemistry II course is to synthesize basic chemical concepts about the properties of substances at the macroscopic, particle (atomic-molecular) and symbolic levels and to integrate existing and new knowledge into conceptual units.
2.2. Course enrolment requirements and/or entry competences	Course Chemistry I (completed).	Course Chemistry I (completed).

DESCRIPTION OF AMENDMENTS AND MODIFICATIONS TO UNDERGRADUATE, GRADUATE AND INTEGRATED UNDERGRADUATE AND GRADUATE STUDY PROGRAMMES

required for the course		
2.3. Learning outcomes at the level of the programme to which the course contributes	1) Basic knowledge and understanding of the natural sciences (Physics, Chemistry, Biology, Mathematics) underlying the study of Geology 2) Awareness and understanding of the temporal and spatial dimensions in Earth processes 3) Knowledge and understanding of the complex nature of interactions within the geosphere 4) Understanding the need of a rational use of earth resources 5) Basic ability to describe a solution at an abstract level 6) Appreciation of issues concerning sample selection, accuracy, precision and uncertainty during collection, recording and analysis of data in the field and laboratory 7) Ability to formulate and test hypotheses 8) Basic ability to apply appropriate technology and use relevant methods 9) Ability to receive and respond to a variety of information sources (e.g. textual, numerical, verbal, graphical) 10) Ability to conduct appropriate experiments, to analyse and interpret data and draw conclusions 11) Ability to use spreadsheet and word-processing software 12) Ability to work effectively as an individual and as a member of a team 13) Ability to organise their own work independently 14) Basic ability to communicate effectively in written and verbal form with colleagues, other professionals, customers and the general public about substantive issues and problems related to their chosen specialisation	**1) Recognise and apply basic and specific knowledge related to the fundamental laws of natural science in the interpretation of geological processes.** **5) Apply information technologies (IT)when processing and presenting data.** **6) Perform relevant experiments and analyses independently or in a group and present data using suitable qualitative and quantitative methods.** **10) Identify problems related to sampling and data processing in field and laboratory research.** **11) Organise field and laboratory data and compare them with acquired professional knowledge.**
2.4. Expected learning outcomes at the level of the course (3-10 learning outcomes)	The student will be able to: 8) Describe and explain the factors that affect the energy, speed and balance of chemical reactions. 9) Explain and describe the properties of compounds of elements of the main groups of the periodic table.	The student will be able to: 1) Describe and explain the factors that affect the energy, speed and balance of chemical reactions. 2) Explain and describe the properties of compounds of elements of the main groups of the periodic table.

DESCRIPTION OF AMENDMENTS AND MODIFICATIONS TO UNDERGRADUATE, GRADUATE AND INTEGRATED UNDERGRADUATE AND GRADUATE STUDY PROGRAMMES

<table>
<tr><td></td><td colspan="9">10) Distinguish organic compounds according to their functional groups.
11) Connect the properties of inorganic and organic compounds with their structure.
12) Properly perform basic laboratory procedures and know how to present experimental ones.</td><td colspan="9">3) Distinguish organic compounds according to their functional groups.
4) Connect the properties of inorganic and organic compounds with their structure.
5) Properly perform basic laboratory procedures and know how to present experimental ones.</td></tr>
<tr><td>2.5. Course content (syllabus)</td><td colspan="9"></td><td colspan="9">1) Introduction, practical skills in chemistry
2) Acids and bases
3) Chemical thermodynamics
4) Galvanic article, electrolysis
5) Chemical kinetics
6) Chemical balance
7) Overview
8) Hydrogen, noble gases
9) Elements of the 1st and 2nd groups of the periodic table
10) Elements of the 13th and 14th groups of the periodic table
11) Elements of the 15th and 16th groups of the periodic table
12) Elements of the 17th group of the periodic table
13) Transitional elements
14) New materials, organic chemistry
15) Overview</td></tr>
<tr><td>2.6. Format of instruction:</td><td colspan="5">☒ lectures
☐ seminars and workshops
☐ exercises
☐ online in entirety
☐ partial e-learning
☐ field work</td><td colspan="4">☒ independent assignments
☐ multimedia and the internet
☒ laboratory
☐ work with mentor
☐ (other)</td><td colspan="5">☒ lectures
☐ seminars and workshops
☐ exercises
☐ online in entirety
☒ partial e-learning
☐ field work</td><td colspan="4">☒ independent assignments
☐ multimedia and the internet
☒ laboratory
☐ work with mentor
☐ (other)</td></tr>
<tr><td>2.7. Comments:</td><td colspan="9"></td><td colspan="9"></td></tr>
<tr><td>2.8. Student obligations</td><td colspan="9"></td><td colspan="9">Regular attendance of classes (lectures and practicum exercises), completed all practicum exercises.</td></tr>
<tr><td rowspan="2">2.9. Monitoring student work</td><td>Class attendance</td><td>YES</td><td></td><td>Research</td><td></td><td>NO</td><td>Oral exam</td><td>YES</td><td></td><td>Class attendance</td><td>YES</td><td></td><td>Research</td><td></td><td>NO</td><td>Oral exam</td><td>YES</td><td></td></tr>
<tr><td>Experimental work</td><td>YES</td><td></td><td>Report</td><td>YES</td><td></td><td>(other)</td><td></td><td>NO</td><td>Experimental work</td><td>YES</td><td></td><td>Report</td><td>YES</td><td></td><td>(other)</td><td></td><td>NO</td></tr>
</table>

DESCRIPTION OF AMENDMENTS AND MODIFICATIONS TO UNDERGRADUATE, GRADUATE AND INTEGRATED UNDERGRADUATE AND GRADUATE STUDY PROGRAMMES

	Essay		NO	Seminar paper		NO	(other)		NO	Essay		NO	Seminar paper		NO	(other)		NO
	Preliminary exam	YES		Practical work	YES		(other)		NO	Preliminary exam	YES		Practical work	YES		(other)		NO
	Project		NO	Written exam	YES		ECTS (total)	5		Project		NO	Written exam	YES		ECTS (total)	5	

	Title	Number of copies in the library	Availability via other media	Title	Number of copies in the library	Availability via other media
2.10. Required literature (available in the library and/or via other media)	Silberberg, M.S. (2009): *Chemistry, 5. ed.,* McGraw-Hill, New York	YES	NO	Silberberg, M.S. (2009): *Chemistry, 5. ed.,* McGraw-Hill, New York	YES	NO
	Sikirica, M. (2008): *Stehiometrija*, Školska knjiga, Zagreb	YES	NO	Sikirica, M. (2008): *Stehiometrija*, Školska knjiga, Zagreb	YES	NO
	Chang, R. (2007): *Chemistry, 9. ed*., McGraw-Hill, New York	YES	NO	Chang, R. (2007): *Chemistry, 9. ed*., McGraw-Hill, New York	YES	NO
	Filipović, I., Lipanović, S. (1991): *Opća i anorganska kemija I*, Školska knjiga, Zagreb,	YES	NO	Filipović, I., Lipanović, S. (1991): *Opća i anorganska kemija I*, Školska knjiga, Zagreb,	YES	NO
	Filipović, I., Lipanović, S. (1991): *Opća i anorganska kemija II*, Školska knjiga, Zagreb	YES	NO	Filipović, I., Lipanović, S. (1991): *Opća i anorganska kemija II*, Školska knjiga, Zagreb	YES	NO
	Grdenić, D. (2006): *Molekule i kristali, 5. obnovljeno i dopunjeno izdanje*, Školska knjiga, Zagreb	YES	NO	Grdenić, D. (2006): *Molekule i kristali, 5. obnovljeno i dopunjeno izdanje*, Školska knjiga, Zagreb	YES	NO
2.11. Optional literature						

DESCRIPTION OF AMENDMENTS AND MODIFICATIONS TO UNDERGRADUATE, GRADUATE AND INTEGRATED UNDERGRADUATE AND GRADUATE STUDY PROGRAMMES

Table 2B Description of the course that was amended and/or modified – Physics

1. COURSE DECRIPTION – GENERAL INFORMATION		
	Before the modification	**After the modification**
1.1. Course teacher	Associate Professor Dalibor Paar, PhD	Associate Professor Dalibor Paar, PhD
1.2. Name of the course	Physics	Physics
1.3. Associate teachers	Lucija Tomašić, Mag. Phys.	**Assistant according to the assignment schedule (exercises)**
1.4. Study programme (undergraduate, graduate, integrated)	Undergraduate	Undergraduate
1.5. Status of the course	Mandatory	Mandatory
1.6. Year of the study	1st	1st
1.7. ECTS credits	6	6
1.8. Type of instruction (number of hours L + E + S + e-learning)	45 + 30 + 0 + 0	45 + 30 + 0 + 0
1.9. Expected enrolment in the course		30
1.10. Level of application of e-learning (level 1, 2, 3), percentage of online instruction (max. 20%)		**Level 1, 5 %**
2.1. Course objectives	The course examines the fundamental laws required for geological practice. The lectures are accompanied with a number of demonstrative experiments explaining fundamental physical laws. The basics to the geophysics methods are also covered. Numerical class-related exercises are given.	**Basic physical laws are discussed and applied to selected examples from geology, along with solving quantitative problems. There is a special emphasis on demonstration experiments that provide direct insight into certain physical laws. Get acquainted with different physical methods (spectroscopy, analytical methods, etc.) used in geological studies.**
2.2. Course enrolment requirements and/or entry competences required for the course		**Mathematics I – completed.**

DESCRIPTION OF AMENDMENTS AND MODIFICATIONS TO UNDERGRADUATE, GRADUATE AND INTEGRATED UNDERGRADUATE AND GRADUATE STUDY PROGRAMMES

2.3. Learning outcomes at the level of the programme to which the course contributes	1) Basic knowledge and understanding of the natural sciences (Physics, Chemistry, Biology, Mathematics) underlying the study of Geology. 2) Knowledge and understanding of the essential features, processes, materials, history and the development of the Earth and life 3) Basic ability to describe a solution at an abstract level. 4) Ability to use simple quantitative physical methods and to apply them to geological problems. 5) Basic ability to solve numerical problems using computer and non-computer based techniques. 6) Recognition of the need for, and engagement in self-managed and life-long learning	**1) Recognise and apply basic and specific knowledge related to the fundamental laws of natural science in the interpretation of geological processes.** **2) Select and use suitable geological methods and specific technologies in solving geological problems.**
2.4. Expected learning outcomes at the level of the course (3-10 learning outcomes)		**1) Identify simple physical problems and propose possible solutions.** **2) Recognize and apply physical concepts in the interpretation of geological processes.** **3) Recognize physical foundations and apply physical methods and measuring instruments in geology.**
2.5. Course content (syllabus)	Mechanics Definition of standards. Concept of vectors and scalars. Scalar product. Product of two vectors. Kinematics: velocity, acceleration, kinetic energy, free fall and the concept of potential energy. The first, the second and the third Newton ‘s Law (The concept of mass, force). Gravitational force. Frictional force. Conservative and nonconservative forces. The power. Momentum and its conservation. Harmonic oscillations, damped and driven oscillations. The waves: the progressive wave, standing wave, transversal and longitudinal waves. The basic concepts of hydrostatics and hydrodynamics. Heat and Thermodynamics The concept of temperature, heat and specific heat. Thermal expansion. Phase diagrams, phase transitions. Geothermic gradients and porosity of rocks. The first and the second law of thermodynamics. The internal energy. Reversible and irreversible transformations. Work in the isothermal, isobaric and	**1) History of physics. SI units and scientific notation. Physical measurements and processing.** **2) Forces. Concepts of force and mass. Coordinate systems and the Earth.** **3) General law of gravitation and laws of motion.** **4) Centripetal and centrifugal force. Coriolis effect. Static and kinetic friction. Harmonic force.** **5) Movement. Statics and dynamics of the body. Forces and motions. Movement of material down the slope. Laws of conservation. Movement of the Earth.** **6) Gravity. Cavendish's experiment. Field, potential and potential energy. Geoid and satellite gravimetry. Tides and low tides. Movement of satellites.** **7) Waves and acoustics. Wave properties. Sound. Doppler effect. Earth waves.** **8) Atomic structure. Radioactivity.** **9) Radiometric dating. Age of the Earth.**

DESCRIPTION OF AMENDMENTS AND MODIFICATIONS TO UNDERGRADUATE, GRADUATE AND INTEGRATED UNDERGRADUATE AND GRADUATE STUDY PROGRAMMES

<table>
<tr><td></td><td colspan="8">adiabatic processes. The Carnot circle. Entropy. The reversible Carnot circle. Blackbody radiation laws.
Electricity and Magnetism.
Coulomb’s law. The electric field strength and potential. A dipole in electric field. Current. Resistance. Work and power. Electric conductance. Capacitance. Electromagnetic induction and the Lorentz force. Faraday ‘s Law of induction. The transformer. Magnetic properties of material. The oscillatory circuit. Resonance. Electromagnetic waves.
Optics and Atomic Physics
The basic of optics. Mirrors and lenses. Microscope. Interference, diffraction and polarization of light. Diffraction grating. Resolution of microscope, diffraction grating and spectrometer. Bohr’s model of hydrogen atom. Spectra. Planck radiation law. Photoelectric effect. Electron microscope. Laser.</td><td colspan="8">10) Optics and spectroscopy. Electromagnetic waves. Luminescence.
11) Geometric optics. Geological polarization microscope.
12) X-ray and electron spectroscopy.
13) Laws of thermodynamics. Gases. Heat flow. Greenhouse effect. Geothermal gradient. Thermal expansion of rocks.
14) Electricity. Electric force. Ohm's law. Magnetism. Magnetic field. Magnetic force. Earth's magnetism.
15) Fluids and fluid flow. Capillarity and surface tension. Fluid statics. Fluid flow.</td></tr>
<tr><td>2.6. Format of instruction:</td><td colspan="4">☒ lectures
☐ seminars and workshops
☒ exercises
☐ online in entirety
☐ partial e-learning
☐ field work</td><td colspan="4">☐ independent assignments
☐ multimedia and the internet
☐ laboratory
☐ work with mentor
☐ (other)</td><td colspan="4">☒ lectures
☐ seminars and workshops
☒ exercises
☐ online in entirety
☐ partial e-learning
☐ field work</td><td colspan="4">☒ independent assignments
☒ multimedia and the internet
☐ laboratory
☐ work with mentor
☐ (other)</td></tr>
<tr><td>2.7. Comments:</td><td colspan="8"></td><td colspan="8"></td></tr>
<tr><td>2.8. Student obligations</td><td colspan="8"></td><td colspan="8">Attending lectures and exercises, taking two colloquiums.</td></tr>
<tr><td>2.9. Monitoring student work</td><td>Class attendance</td><td>YES</td><td></td><td>Research</td><td></td><td>NO</td><td>Oral exam</td><td>YES</td><td></td><td>Class attendance</td><td>YES</td><td></td><td>Research</td><td></td><td>NO</td><td>Oral exam</td><td>YES</td><td></td></tr>
<tr><td></td><td>Experimental work</td><td></td><td>NO</td><td>Report</td><td></td><td>NO</td><td>(other)</td><td></td><td>NO</td><td>Experimental work</td><td></td><td>NO</td><td>Report</td><td></td><td>NO</td><td>(other)</td><td></td><td>NO</td></tr>
<tr><td></td><td>Essay</td><td></td><td>NO</td><td>Seminar paper</td><td></td><td>NO</td><td>(other)</td><td></td><td>NO</td><td>Essay</td><td></td><td>NO</td><td>Seminar paper</td><td></td><td>NO</td><td>(other)</td><td></td><td>NO</td></tr>
<tr><td></td><td>Preliminary exam</td><td>YES</td><td></td><td>Practical work</td><td></td><td>NO</td><td>(other)</td><td></td><td>NO</td><td>Preliminary exam</td><td>YES</td><td></td><td>Practical work</td><td></td><td>NO</td><td>(other)</td><td></td><td>NO</td></tr>
<tr><td></td><td>Project</td><td></td><td>NO</td><td>Written exam</td><td></td><td>NO</td><td>ECTS (total)</td><td>6</td><td></td><td>Project</td><td></td><td>NO</td><td>Written exam</td><td></td><td>NO</td><td>ECTS (total)</td><td>6</td><td></td></tr>
<tr><td>2.10. Required literature (available in the library</td><td colspan="4">Title</td><td>Number of copies</td><td colspan="3">Availability via other media</td><td colspan="4">Title</td><td>Number of copies in the library</td><td colspan="3">Availability via other media</td></tr>
</table>

DESCRIPTION OF AMENDMENTS AND MODIFICATIONS TO UNDERGRADUATE, GRADUATE AND INTEGRATED UNDERGRADUATE AND GRADUATE STUDY PROGRAMMES

and/or via other media)		**in the library**				
				Chapman, R.E. (2002): *Physics for geologists, 2ed,* Routledge, London & New York.	**YES**	**NO**
				Paar, D. (2023): *Physics, for geologists, internal script,* Zagreb.	**NO**	**YES**
2.11. Optional literature				**Cutnell, J.D., Johnson, K.W. (2013): *Introduction to Physics, 9th Edition*, Wiley.**		

DESCRIPTION OF AMENDMENTS AND MODIFICATIONS TO UNDERGRADUATE, GRADUATE AND INTEGRATED UNDERGRADUATE AND GRADUATE STUDY PROGRAMMES

Table 2B Description of the course that was amended and/or modified – General Paleontology

1. COURSE DECRIPTION – GENERAL INFORMATION		
	Before the modification	**After the modification**
1.1. Course teacher	Full Professor with tenure Vlasta Ćosović, PhD, Assistant Professor Karmen Fio Firi, PhD	**Assistant Professor Karmen Fio Firi, PhD**
1.2. Name of the course	General Paleontology	General Paleontology
1.3. Associate teachers	Valerije Makarun, Mag. Geol.	Valerije Makarun, Mag. Geol.
1.4. Study programme (undergraduate, graduate, integrated)	Undergraduate	Undergraduate
1.5. Status of the course	Mandatory	Mandatory
1.6. Year of the study	1st	1st
1.7. ECTS credits	7	**6**
1.8. Type of instruction (number of hours L + E + S + e-learning)	45 + 45 + 0 + 0	45 + **30 + 15** + 0
1.9. Expected enrolment in the course	36	36
1.10. Level of application of e-learning (level 1, 2, 3), percentage of online instruction (max. 20%)	Level 1, up to 3 %	Level 1, up to 3 %
2.1. Course objectives	Getting familiar with essential terms, principles and applications of palaeontology. Short review of the main fossil groups.	Getting familiar with essential terms, principles and applications of palaeontology. Short review of the most important fossil groups.
2.2. Course enrolment requirements and/or entry competences required for the course		
2.3. Learning outcomes at the level of the programme to which the course contributes	GL_2 – Knowledge and understanding of the essential features, processes, materials, history and the development of the Earth and life. GL_3 – Basic knowledge and understanding of the key aspects and concepts of geology.	**1) Recognise and apply basic and specific knowledge related to the fundamental laws of natural science in the interpretation of geological processes.** **2) Identify basic geological processes and geological materials, and connect them with the development of life on Earth and Earth itself.**

	GL_4 – Knowledge of the common terminology and nomenclature and the use of bibliography in Geosciences. GL_5 – An awareness of the wider spectrum of geological disciplines. GL_6 – Awareness and understanding of the temporal and spatial dimensions in Earth processes. GL_8 – Awareness of major geological paradigms, the extent of geological time and Plate Tectonics. GL_9 – Knowledge and understanding of the complex nature of interactions within the geosphere. GL_11 – Ability to create simple geological models. GL_14 – Basic ability in the formalisation and specification of problems whose solution involves the use of geological methods. GL_15 – Knowledge of appropriate solution patterns for geological problems. GL_16 – Basic ability to describe a solution at an abstract level. GL_17 – Knowledge of the range of applications of Geology. GL_21 – Basic ability to become familiar with new geological methods and technologies. GL_23 – Ability to use simple quantitative methods and to apply them to geological problems. GL_37 – Ability to organise their own work independently.	**3) Identify simple geological problems and suggest possible solutions.** 4) **Apply information technologies (IT) when processing and presenting data.**
2.4. Expected learning outcomes at the level of the course (3-10 learning outcomes)		**1) Describe and recognize the ways of formation of fossils, in theory and with examples.** **2) Recognize the type and explain the formation of fossil deposits.** **3) Assess the preservation potential of individual groups of organisms.** **4) Describe and partly apply the basic methods of work in paleontology.** **5) Recognize and distinguish individual fossils and describe and compare their main skeletal elements.** **6) Apply the basics of natural systematics and classify which group each fossil belongs to.**

DESCRIPTION OF AMENDMENTS AND MODIFICATIONS TO UNDERGRADUATE, GRADUATE AND INTEGRATED UNDERGRADUATE AND GRADUATE STUDY PROGRAMMES

			7) Interpret fossil environments based on knowledge from paleontology and other geological disciplines. **8) Apply analytical methods to analyse the basic settings of paleoecology, paleoclimatology and paleobiogeography.** **9) Apply fossils in determining the relative age of rocks and the history of life on Earth.**	
2.5. Course content (syllabus)	1) Basic concepts and definitions in paleontology. 2) Taphonomic processes, fossilization. 3) Fossil deposits. 4) Species in paleontology, higher taxonomic category. 5) Structure and mineralogy of the skeleton. 6) A brief overview of Monera and Protista. 7) A brief overview of the kingdoms Fungi and Plantae. 8) Kingdom Animalia / Invertebrata. 9) Kingdom Animalia / Vertebrata. 10) Introduction to paleoecology. 11) Fossil communities and taphofacies. 12) Evolution and extinction. 13) Introduction to biostratigraphy. 14) Origin and development of life through the geological past. 15) Methods in paleontology.		1) Basic concepts and definitions in paleontology. **Work methods in paleontology.** Taphonomic processes. 2) Fossilization. Fossil deposits **(concentration and conservation). Preservation potential**. **3) Taxonomy. Systematics in paleontology. Paleontological species. Nomenclature rules.** 4) Mineralogy and structure of the skeleton. **5) Animalia (Avertebrata I) – Porifera, Cnidaria, Mollusca.** **6) Animalia (Avertebrata II) – Bryozoa, Brachiopoda.** **7) Animalia (Avertebrata III) – Annelida, Arthropoda, Echinodermata, Hemichordata.** 8) Animalia (Vertebrata). **9) Prokaryota, Protoctista. Microfacies.** **10) Plantae.** 11) Evolution. Extinction. 12) **Absolute and relative age. Basic principles of biostratigraphy and chronostratigraphy. Index fossils.** **13) Basic principles of paleoecology (abiotic and biotic factors, distribution of organisms).** **14) Basic principles of paleoclimatology and paleobiogeography (application of stable isotopes).** **15) Development of life on Earth.**	
2.6. Format of instruction:	☒ lectures ☐ seminars and workshops ☒ exercises ☐ online in entirety ☐ partial e-learning ☐ field work	☒ independent assignments ☐ multimedia and the internet ☐ laboratory ☐ work with mentor ☐ (other)	☒ lectures ☒ **seminars and workshops** ☒ exercises ☐ online in entirety ☐ partial e-learning ☐ field work	☒ independent assignments ☐ multimedia and the internet ☒ **laboratory** ☐ work with mentor ☐ (other)
2.7. Comments:			**A decrease in ECTS points from 7 to 6 is requested, as well as modification of the type of instruction (a change of number of**	

DESCRIPTION OF AMENDMENTS AND MODIFICATIONS TO UNDERGRADUATE, GRADUATE AND INTEGRATED UNDERGRADUATE AND GRADUATE STUDY PROGRAMMES

<table>
<tr><td></td><td colspan="9"></td><td colspan="9">exercise hours from 45 to 30, and seminar hours from 0 to 15) and transfer of the course from I to II semester (an exchange with the course Fundamentals of Biology).</td></tr>
<tr><td>2.8. Student obligations</td><td colspan="9"></td><td colspan="9">Regular attendance of classes and active participation in the creation of assignments.</td></tr>
<tr><td rowspan="6">2.9. Monitoring student work</td><td>Class attendance</td><td>YES</td><td></td><td>Research</td><td></td><td>NO</td><td>Oral exam</td><td></td><td>NO</td><td>Class attendance</td><td>YES</td><td></td><td>Research</td><td></td><td>NO</td><td>Oral exam</td><td>YES</td><td></td></tr>
<tr><td>Experimental work</td><td></td><td>NO</td><td>Report</td><td></td><td>NO</td><td>(other)</td><td></td><td>NO</td><td>Experimental work</td><td></td><td>NO</td><td>Report</td><td></td><td>NO</td><td>(other)</td><td></td><td>NO</td></tr>
<tr><td>Essay</td><td></td><td>NO</td><td>Seminar paper</td><td></td><td>NO</td><td>(other)</td><td></td><td>NO</td><td>Essay</td><td></td><td>NO</td><td>Seminar paper</td><td>YES</td><td></td><td>(other)</td><td></td><td>NO</td></tr>
<tr><td>Preliminary exam</td><td>YES</td><td></td><td>Practical work</td><td>YES</td><td></td><td>(other)</td><td></td><td>NO</td><td>Preliminary exam</td><td>YES</td><td></td><td>Practical work</td><td>YES</td><td></td><td>(other)</td><td></td><td>NO</td></tr>
<tr><td>Project</td><td></td><td>NO</td><td>Written exam</td><td>YES</td><td></td><td>ECTS (total)</td><td>7</td><td></td><td>Project</td><td></td><td>NO</td><td>Written exam</td><td>YES</td><td></td><td>ECTS (total)</td><td colspan="2">6</td></tr>
<tr><td colspan="10"></td></tr>
<tr><td rowspan="5">2.10. Required literature (available in the library and/or via other media)</td><td colspan="3">Title</td><td>Number of copies in the library</td><td>Availability via other media</td><td colspan="3">Title</td><td>Number of copies in the library</td><td>Availability via other media</td></tr>
<tr><td colspan="3">Doyle, P. (1996): Understanding Fossils, Wiley, Chichester</td><td>NO</td><td>NO</td><td colspan="3">Clarkson, E.N.K. (2008): Invertebrate Palaeontology and Evolution, Blackwell Publishing, 452 p.</td><td>YES</td><td>YES</td></tr>
<tr><td colspan="3">Raup, D.M., Stanley, S.M. (1978): Principles of Palaeontology. Freeman, San Francisco</td><td>NO</td><td>NO</td><td colspan="3">Sremac, J. (1999): Opća paleontologija. Skripta, Prirodoslovno-matematički fakultet Sveučilišta u Zagrebu, 192 p.</td><td>YES</td><td>YES</td></tr>
<tr><td colspan="3">Sremac, J. (1999): Opća paleontologija. Skripta, Prirodoslovno-matematički fakultet Sveučilišta u Zagrebu, 192 p.</td><td>YES</td><td>YES</td><td colspan="3">Taylor, P.D., Lewis, D.N. (2005) Fossil Invertebrates, Harvard University Press, Cambridge, Massachussets, 208 p.</td><td>YES</td><td>NO</td></tr>
<tr><td colspan="3"></td><td></td><td></td><td colspan="3"></td><td></td><td></td></tr>
<tr><td>2.11. Optional literature</td><td colspan="5"></td><td colspan="5">Doyle, P. (1996): Understanding Fossils, Wiley, Chichester
Prothero, D.R. (1998): Bringing Fossils to Life – an introduction to Paleobiology, McGraw-Hill, London
Raup, D.M. Stanley, S.M. (1978): Principles of Palaeontology, Freeman, San Francisco</td></tr>
</table>

DESCRIPTION OF AMENDMENTS AND MODIFICATIONS TO UNDERGRADUATE, GRADUATE AND INTEGRATED UNDERGRADUATE AND GRADUATE STUDY PROGRAMMES

Table 2B Description of the course that was amended and/or modified – System of Mineralogy

1. COURSE DECRIPTION – GENERAL INFORMATION		
	Before the modification	**After the modification**
1.1. Course teacher	Assistant Professor Andrea Čobić, PhD	Assistant Professor Andrea Čobić, PhD
1.2. Name of the course	System of Mineralogy	System of Mineralogy
1.3. Associate teachers	Laura Posarić, Mag. Ing. Geol. Zvonka Gverić, Mag. Geol.	Laura Posarić, Mag. Ing. Geol. Zvonka Gverić, Mag. Geol.
1.4. Study programme (undergraduate, graduate, integrated)	Undergraduate	Undergraduate
1.5. Status of the course	Mandatory	Mandatory
1.6. Year of the study	1st	1st
1.7. ECTS credits	7	**6**
1.8. Type of instruction (number of hours L + E + S + e-learning)	45 + 45 + 0 + 0	45 + 45 + 0 + 0
1.9. Expected enrolment in the course	35	35
1.10. Level of application of e-learning (level 1, 2, 3), percentage of online instruction (max. 20%)	Level 1, 0 %	Level 1, 0 %
2.1. Course objectives	To familiarize students with mineral classification and nomenclature. It is also presumed familiarization with basic genetic and paragenetic mineral features, as well as with the most common uses of minerals in modern-day technologies.	**Get to know crystal-chemical properties of non-silicate and silicate minerals. To recognize different mineral species in macroscopic samples based on their physical properties. To recognize basic mineral associations in macroscopic samples. To familiarize with basic uses in modern-day technologies of the most important mineral species.**
2.2. Course enrolment requirements and/or entry competences required for the course	Completed courses Chemistry I and General Mineralogy.	Completed courses Chemistry I and General Mineralogy.

DESCRIPTION OF AMENDMENTS AND MODIFICATIONS TO UNDERGRADUATE, GRADUATE AND INTEGRATED UNDERGRADUATE AND GRADUATE STUDY PROGRAMMES

2.3. Learning outcomes at the level of the programme to which the course contributes	GL_1. Basic knowledge and understanding of the natural sciences (Physics, Chemistry, Biology, Mathematics) underlying the study of Geology. GL_2. Knowledge and understanding of the essential features, processes, materials, history and the development of the Earth and life GL_3. Basic knowledge and understanding of the key aspects and concepts of geology. GL_9. Knowledge and understanding of the complex nature of interactions within the geosphere. GL_10. Appropriate knowledge of other disciplines relevant to geology. GL_13. Understanding the need of a rational use of earth resources. GL_16. Basic ability to describe a solution at an abstract level. GL_17. Knowledge of the range of applications of Geology. GL_27. Ability to undertake literature searches, and to use data bases and other sources of information. GL_28. Ability to receive and respond to a variety of information sources (e.g. textual, numerical, verbal, graphical).	**1) Recognize and apply basic and specific knowledge related to the fundamental laws of natural science in the interpretation of geological processes.** **2) Identify basic geological processes and geological materials, and connect them with the development of life on Earth and Earth itself.** **3) Identify simple geological problems and suggest possible solutions.**
2.4. Expected learning outcomes at the level of the course (3-10 learning outcomes)	1) Basic knowledge and understanding of the mineral classification and nomenclature. 2) Ability to use macroscopical characteristics of minerals. 3) Ability to recognize of most frequent minerals.	**1) Express and demonstrate knowledge of mineral classification and nomenclature basic principles.** **2) Describe selected mineral species and varieties.** **3) Recognize physical mineral properties in macroscopic samples.** **4) To identify minerals in macroscopic samples based on their physical properties.** **5) To identify mineral associations in macroscopic samples.**
2.5. Course content (syllabus)	1) Historical principles of mineral classification. Crystal-chemical classification of minerals. Classification of minerals. 2) Elements. 3) Sulphides. 4) Oxides. 5) Halogenides. 6) Carbonates. 7) Nitrates, iodates and borates.	1) Historical principles of mineral classification. Crystal-chemical classification of minerals. 2) Elements. 3) Sulphides. 4) Oxides. 5) Halogenides. 6) Carbonates. 7) Nitrates, iodates and borates. 8) Sulphates.

DESCRIPTION OF AMENDMENTS AND MODIFICATIONS TO UNDERGRADUATE, GRADUATE AND INTEGRATED UNDERGRADUATE AND GRADUATE STUDY PROGRAMMES

<table>
<tr><td></td><td colspan="9">8) Sulphates.
9) Phosphates.
10) Molibdates, tungstenates and organic minerals.
11) Nesosilicates.
12) Sorosilicates and cyclosilicates.
13) Inosilicates.
14) Phyllosilicates.
15) Tectosilicates.</td><td colspan="9">9) Phosphates.
10) Molibdates, tungstenates and organic minerals.
11) Nesosilicates.
12) Sorosilicates and cyclosilicates.
13) Inosilicates.
14) Phyllosilicates.
15) Tectosilicates.</td></tr>
<tr><td>2.6. Format of instruction:</td><td colspan="5">☒ lectures
☐ seminars and workshops
☒ exercises
☐ online in entirety
☐ partial e-learning
☐ field work</td><td colspan="4">☐ independent assignments
☐ multimedia and the internet
☐ laboratory
☐ work with mentor
☐ (other)</td><td colspan="5">☒ lectures
☐ seminars and workshops
☒ exercises
☐ online in entirety
☐ partial e-learning
☐ field work</td><td colspan="4">☐ independent assignments
☐ multimedia and the internet
☐ laboratory
☐ work with mentor
☐ (other)</td></tr>
<tr><td>2.7. Comments:</td><td colspan="9"></td><td colspan="9">A decrease in ECTS points from 7 to 6 is requested.</td></tr>
<tr><td>2.8. Student obligations</td><td colspan="9">In addition to the prior knowledge, students must regularly attend classes and take the colloquiums.</td><td colspan="9">Regular attendance of classes.</td></tr>
<tr><td rowspan="5">2.9. Monitoring student work</td><td>Class attendance</td><td>YES</td><td></td><td>Research</td><td></td><td>NO</td><td>Oral exam</td><td>YES</td><td></td><td>Class attendance</td><td>YES</td><td></td><td>Research</td><td></td><td>NO</td><td>Oral exam</td><td>YES</td><td></td></tr>
<tr><td>Experimental work</td><td></td><td>NO</td><td>Report</td><td></td><td>NO</td><td>(other)</td><td></td><td>NO</td><td>Experimental work</td><td></td><td>NO</td><td>Report</td><td></td><td>NO</td><td>(other)</td><td></td><td>NO</td></tr>
<tr><td>Essay</td><td></td><td>NO</td><td>Seminar paper</td><td></td><td>NO</td><td>(other)</td><td></td><td>NO</td><td>Essay</td><td></td><td>NO</td><td>Seminar paper</td><td></td><td>NO</td><td>(other)</td><td></td><td>NO</td></tr>
<tr><td>Preliminary exam</td><td>YES</td><td></td><td>Practical work</td><td>YES</td><td></td><td>(other)</td><td></td><td>NO</td><td>Preliminary exam</td><td>YES</td><td></td><td>Practical work</td><td>YES</td><td></td><td>(other)</td><td></td><td>NO</td></tr>
<tr><td>Project</td><td></td><td>NO</td><td>Written exam</td><td>YES</td><td></td><td>ECTS (total)</td><td>7</td><td></td><td>Project</td><td></td><td>NO</td><td>Written exam</td><td>YES</td><td></td><td>ECTS (total)</td><td colspan="2">6</td></tr>
<tr><td rowspan="3">2.10. Required literature (available in the library and/or via other media)</td><td colspan="5">Title</td><td>Number of copies in the library</td><td colspan="2">Availability via other media</td><td colspan="5">Title</td><td>Number of copies in the library</td><td colspan="2">Availability via other media</td></tr>
<tr><td colspan="5">Bermanec, V. (1999): System of mineralogy – mineralogy of non-silicate minerals. Targa, Zagreb, 264 p.</td><td>YES</td><td colspan="2">NO</td><td colspan="5">Bermanec, V. (1999): System of mineralogy – mineralogy of non-silicate minerals. Targa, Zagreb, 264 p.</td><td>YES</td><td colspan="2">NO</td></tr>
<tr><td colspan="5">Bermanec, V., Slovenec, D. (2006): System of mineralogy –</td><td>YES</td><td colspan="2">NO</td><td colspan="5">Bermanec, V., Slovenec, D. (2006): System of mineralogy – mineralogy of</td><td>YES</td><td colspan="2">NO</td></tr>
</table>

DESCRIPTION OF AMENDMENTS AND MODIFICATIONS TO UNDERGRADUATE, GRADUATE AND INTEGRATED UNDERGRADUATE AND GRADUATE STUDY PROGRAMMES

	mineralogy of silicate minerals. Denona, Zagreb, 359 p.			*silicate minerals*. Denona, Zagreb, 359 p.		
2.11. Optional literature	Wenk, H.-R. Bulakh, A. (2006): *Minerals their Constitution and Origin*, Cambridge University Press, 672 p. Hibbard, M.J. (2001): *Mineralogy A Geologist's Point of View*, McGraw-Hill Science, 576 p.			Wenk, H.-R. Bulakh, A. (2006): *Minerals their Constitution and Origin*, Cambridge University Press, 672 p. Hibbard, M.J. (2001): *Mineralogy A Geologist's Point of View*, McGraw-Hill Science, 576 p.		

DESCRIPTION OF AMENDMENTS AND MODIFICATIONS TO UNDERGRADUATE, GRADUATE AND INTEGRATED UNDERGRADUATE AND GRADUATE STUDY PROGRAMMES

Table 2B Description of the course that was amended and/or modified – Field course in Geology I

1. COURSE DECRIPTION – GENERAL INFORMATION		
	Before the modification	**After the modification**
1.1. Course teacher	Full Professor Blanka Cvetko Tešović, PhD, Dražen Kurtanjek, MSc, Assistant Professor Maja Martinuš, PhD	Full Professor Blanka Cvetko Tešović, PhD, Dražen Kurtanjek, MSc, Assistant Professor Maja Martinuš, PhD
1.2. Name of the course	Field course in Geology I	Field course in Geology I
1.3. Associate teachers		
1.4. Study programme (undergraduate, graduate, integrated)	Undergraduate	Undergraduate
1.5. Status of the course	Mandatory	Mandatory
1.6. Year of the study	1st	1st
1.7. ECTS credits	5	**3**
1.8. Type of instruction (number of hours L + E + S + e-learning)	0 + 0 + 60 + 0	0 + 0 + 60 + 0
1.9. Expected enrolment in the course	36	36
1.10. Level of application of e-learning (level 1, 2, 3), percentage of online instruction (max. 20%)		
2.1. Course objectives	Field application of acquired knowledge. Individual acquisition of geological observations, individual measuring and work on outcrops. Editing of blind geological maps, of a given area.	Field application of acquired knowledge. **Getting to know the geological structure of the field (outcrops); rock types, geological structures, macro- and microfossils. Mastering the basic methods of geological research.** Editing of „blind“ geological maps, of a given area.
2.2. Course enrolment requirements and/or entry competences required for the course	Passed course Physical Geology.	**Completed course Physical Geology.**
2.3. Learning outcomes at the level of the programme to which	GL_2 Knowledge and understanding of the essential features, processes, materials, history and the development of the Earth and life	**1) Recognise and apply basic and specific knowledge related to the fundamental laws of natural science in the interpretation of geological processes.**

the course contributes	GL_3 Basic knowledge and understanding of the key aspects and concepts of geology GL_4 Knowledge of the common terminology and nomenclature and the use of bibliography in Geosciences GL_6 Awareness and understanding of the temporal and spatial dimensions in Earth processes GL_7 Awareness of the applications and responsibilities of Geology and its role in society including its environmental aspects GL_12 Some understanding of the complexity of geological problems and the feasibility of their solution GL_14 Basic ability in the formalisation and specification of problems whose solution involves the use of geological methods GL_15 Knowledge of appropriate solution patterns for geological problems GL_16 Basic ability to describe a solution at an abstract level GL_18 Ability to integrate field and laboratory evidence with theory following the sequence from observation to recognition, synthesis and modelling GL_21 Basic ability to become familiar with new geological methods and technologies GL_22 Basic ability to apply appropriate technology and use relevant methods GL_23. Ability to use simple quantitative methods and to apply them to geological problems GL_24. Basic ability to independently analyse earth materials in the field and laboratory and to describe, process, document and report the results GL_26 Basic ability to combine theory and practice to complete geological tasks GL_29 Ability to conduct appropriate experiments, to analyse and interpret data and draw conclusions GL_35 Ability to work effectively as an individual and as a member of a team	**2) Identify basic geological processes and geological materials, and connect them with the development of life on Earth and Earth itself.** **3) Identify simple geological problems and suggest possible solutions.** **4) Select and use suitable geological methods and specific technologies in solving geological problems.** **5) Use geological maps, domestic and foreign literature and databases, as well as other sources of information.** **Recognise the role of geology in knowledge development, valuation of goods, spatial arrangement, improvement of life quality and environmental preservation**
2.4. Expected learning outcomes at the level of the course		**1) Recognize the content of topographic and geological maps.**

DESCRIPTION OF AMENDMENTS AND MODIFICATIONS TO UNDERGRADUATE, GRADUATE AND INTEGRATED UNDERGRADUATE AND GRADUATE STUDY PROGRAMMES

<table>
<tr><td>(3-10 learning outcomes)</td><td></td><td colspan="10">2) Independently or in a group, orient yourself in the field with the help of a topographic and geological map, and geological compass.
3) Identify different types of rocks in the field.
4) Independently or in a group, used hand lens and geological compass, to measure the attitude of beds on field outcrops.
5) Recognize and explain the basic lithosphere structural elements on the visited areas.
6) Develop independence when keeping a field diary/ field notebook forms the main record of the data and sketches gather in the visited field outcrops.</td></tr>
<tr><td>2.5. Course content (syllabus)</td><td colspan="2">Study of rock types and minerals in field. Learning on stratigraphic successions and geological composition of the visited area. Measuring the attitude of beds and faults, reconstruction of folds after acquired data. Study of slope processes and their consequences. Application of basic geological tools. Orientation in the field and by the map. Keeping individual field logs, and collecting samples. After the completed field course students prepare individual written reports with own observations, measurements and geological maps.</td><td colspan="10">Orientation in the field and by the topographical and geological maps. Use of basic geological tools such as geological hammer, hand lens and geological compass. Getting to know the types of rocks and minerals in the field. Getting to know the geological structure in the visited field. Measurement of the attitude of beds. Recognition of simple geological structures such as faults, folds and their reconstruction. Getting to know slope processes and their consequences. Overcome simple field methods, taking samples and data from outcrops, with independence in note taking for a field diary. After completing field lessons, students hand in a field diary with own observations, measurements and geological maps.</td></tr>
<tr><td>2.6. Format of instruction:</td><td colspan="2">☐ lectures
☐ seminars and workshops
☐ exercises
☐ online in entirety
☐ partial e-learning
☒ field work
☐ independent assignments
☐ multimedia and the internet
☐ laboratory
☐ work with mentor
☐ (other)</td><td colspan="10">☐ lectures
☐ seminars and workshops
☐ exercises
☐ online in entirety
☐ partial e-learning
☒ field work
☐ independent assignments
☐ multimedia and the internet
☐ laboratory
☐ work with mentor
☐ (other)</td></tr>
<tr><td>2.7. Comments:</td><td colspan="2"></td><td colspan="10">A decrease in ECTS points from 5 to 3 is requested because the previous number of ECTS points did not correspond to the point value of the course.</td></tr>
<tr><td>2.8. Student obligations</td><td colspan="2">Regular attendance of classes, active work, independent documentation.</td><td colspan="10">Regular attendance of classes, active work, independent documentation - field diary.</td></tr>
<tr><td>2.9. Monitoring student work</td><td>Class attendance</td><td>YES</td><td></td><td>Research</td><td>YES</td><td></td><td>Oral exam</td><td></td><td>NO</td><td>Class attendance</td><td>YES</td><td></td><td>Research</td><td>YES</td><td></td><td>Oral exam</td><td></td><td>NO</td></tr>
</table>

DESCRIPTION OF AMENDMENTS AND MODIFICATIONS TO UNDERGRADUATE, GRADUATE AND INTEGRATED UNDERGRADUATE AND GRADUATE STUDY PROGRAMMES

	Experimental work		NO	Report		NO	(other)		NO	Experimental work		NO	Report		NO	Field diary	**YES**	
	Essay		NO	Seminar paper		NO	(other)		NO	Essay		NO	Seminar paper		NO	(other)		NO
	Preliminary exam		NO	Practical work	YES		(other)		NO	Preliminary exam	**YES**		Practical work	YES		(other)		NO
	Project		NO	Written exam		NO	ECTS (total)	5		Project		NO	Written exam		NO	ECTS (total)	**3**	

2.10. Required literature (available in the library and/or via other media)	**Title**	**Number of copies in the library**	**Availability via other media**	**Title**	**Number of copies in the library**	**Availability via other media**
				Teaching materials	**NO**	**YES**
2.11. Optional literature	Bahun, S. (1993): *Geološko kartiranje*, Školska knjiga, Zagreb			Bahun, S. (1993): *Geološko kartiranje*, Školska knjiga, Zagreb		

DESCRIPTION OF AMENDMENTS AND MODIFICATIONS TO UNDERGRADUATE, GRADUATE AND INTEGRATED UNDERGRADUATE AND GRADUATE STUDY PROGRAMMES

Table 2B Description of the course that was amended and/or modified – Historical Geology I

1. COURSE DECRIPTION – GENERAL INFORMATION		
	Before the modification	**After the modification**
1.1. Course teacher	Full Professor Damir Bucković, PhD	Full Professor Damir Bucković, PhD
1.2. Name of the course	Historical Geology I	Historical Geology I
1.3. Associate teachers		
1.4. Study programme (undergraduate, graduate, integrated)	Undergraduate	Undergraduate
1.5. Status of the course	Mandatory	Mandatory
1.6. Year of the study	2nd	2nd
1.7. ECTS credits	6	**5**
1.8. Type of instruction (number of hours L + E + S + e-learning)	45 + 30 + 0 + 0	**30** + 30 + 0 + 0
1.9. Expected enrolment in the course	25	25
1.10. Level of application of e-learning (level 1, 2, 3), percentage of online instruction (max. 20%)	Level 1, 0 %	Level 1, 0 %
2.1. Course objectives	To introduce students with the spatial and temporal dynamics of the Earth during the Precambrian and Paleozoic, with the development of the living world, and with the structure and mutual relations of Paleozoic chronostratigraphic (rock) units that are present in the territory of the Republic of Croatia.	**Familiarity with** the spatial and temporal dynamics of the Earth during the Precambrian and Paleozoic, with the development of the living world, and with the structure and mutual relations of Paleozoic chronostratigraphic (rock) units that are present in the Republic of Croatia.
2.2. Course enrolment requirements and/or entry competences required for the course	Course in Physical Geology – passed Course in General Paleontology – passed	Course in Physical Geology – passed Course in General Paleontology – passed
2.3. Learning outcomes at the level of the programme to which	1) Basic knowledge and understanding of the key aspects and concepts of geology. 2) Use geological maps, domestic and foreign literature and databases, as well as other sources of information.	1) Basic knowledge and understanding of the key aspects and concepts of geology. 2) Use geological maps, domestic and foreign literature and databases, as well as other sources of information.

DESCRIPTION OF AMENDMENTS AND MODIFICATIONS TO UNDERGRADUATE, GRADUATE AND INTEGRATED UNDERGRADUATE AND GRADUATE STUDY PROGRAMMES

the course contributes	3) Identify problems related to sampling and data processing in field and laboratory research. 4) Organise field and laboratory data and compare them with acquired professional knowledge.	3) Identify problems related to sampling and data processing in field and laboratory research. 4) Organise field and laboratory data and compare them with acquired professional knowledge.
2.4. Expected learning outcomes at the level of the course (3-10 learning outcomes)		**1) Describe and discuss the processes and formation of geological materials and the development of life through the Precambrian and/or Paleozoic.** **2) Interpret the geological structure of a Precambrian and/or Paleozoic area based on the recognition of chronostratigraphic units on the ground and on the geological map.** **3) Identify the litho- and biofacies of the investigated Precambrian and/or Paleozoic rocks by field sampling and sample processing in the laboratory.** 4) **Interpret the geological development of the Precambrian and/or Paleozoic researched terrain and compare it with current knowledge.**
2.5. Course content (syllabus)	1) Founders of Historical Geology 2) Geological time scale 3) Radiometric dating of rock ages 4) Formation of the atmosphere, sea, oceanic and continental crust 5) Structure of cratons and shields 6) Origin of life 7) Life in the Proterozoic 8) Proterozoic shields and Proterozoic rocks 9) Life in the Cambrian and Ordovician 10) Cambrian and Ordovician paleogeography 11) Life in the Silurian and Devonian 12) Silurian and Devonian paleogeography 13) Life in the Carboniferous and Permian 14) Carboniferous and Permian paleogeography 15) Carboniferous and Permian sedimentary development in the Dinarides	1) Founders of Historical Geology 2) **Determining the age of documents of the geological past** 3) **Stratotype**, geological time scale **and stratigraphic classification** 4) **Interpretation of documents of the geological past** 5) Formation of the atmosphere, hydrosphere, oceanic and continental crusts 6) Structure of cratons and shields. The origin of life 7) **Hadij and archaic** 8) Proterozoic and Proterozoic ice ages 9) Cambrian and Ordovician paleogeography 10) Life in the Cambrian and Ordovician 11) Silurian and Devonian paleogeography 12) Life in the Silurian and Devonian 13) Carboniferous and Permian paleogeography 14) Carboniferous and Permian sedimentary development in the Dinarides 15) Life in the Carboniferous and Permian
2.6. Format of instruction:	☒ lectures ☐ seminars and workshops ☐ independent assignments	☒ lectures ☐ seminars and workshops ☐ independent assignments

DESCRIPTION OF AMENDMENTS AND MODIFICATIONS TO UNDERGRADUATE, GRADUATE AND INTEGRATED UNDERGRADUATE AND GRADUATE STUDY PROGRAMMES

<table>
<tr><td></td><td colspan="8">☒ exercises
☐ online in entirety
☐ partial e-learning
☒ field work</td><td colspan="8">☐ multimedia and the internet
☐ laboratory
☐ work with mentor
☐ (other)</td><td colspan="8">☒ exercises
☐ online in entirety
☐ partial e-learning
☒ field work</td><td colspan="8">☐ multimedia and the internet
☐ laboratory
☐ work with mentor
☐ (other)</td></tr>
<tr><td>2.7. Comments:</td><td colspan="8"></td><td colspan="8">A decrease in ECTS points from 6 to 5 is requested, and modification of the type of instruction (a change of number of lecture hours from 45 to 30).</td></tr>
<tr><td>2.8. Student obligations</td><td colspan="8">Regular attendance of classes. Passing a written exam.</td><td colspan="8">Regular attendance of classes. Passing a written exam.</td></tr>
<tr><td rowspan="6">2.9. Monitoring student work</td><td>Class attendance</td><td>YES</td><td></td><td>Research</td><td></td><td>NO</td><td>Oral exam</td><td></td><td>NO</td><td>Class attendance</td><td>YES</td><td></td><td>Research</td><td></td><td>NO</td><td>Oral exam</td><td></td><td>NO</td></tr>
<tr><td>Experimental work</td><td></td><td>NO</td><td>Report</td><td></td><td>NO</td><td>(other)</td><td></td><td>NO</td><td>Experimental work</td><td></td><td>NO</td><td>Report</td><td></td><td>NO</td><td>(other)</td><td></td><td>NO</td></tr>
<tr><td>Essay</td><td></td><td>NO</td><td>Seminar paper</td><td></td><td>NO</td><td>(other)</td><td></td><td>NO</td><td>Essay</td><td></td><td>NO</td><td>Seminar paper</td><td></td><td>NO</td><td>(other)</td><td></td><td>NO</td></tr>
<tr><td>Preliminary exam</td><td></td><td>NO</td><td>Practical work</td><td></td><td>NO</td><td>(other)</td><td></td><td>NO</td><td>Preliminary exam</td><td></td><td>NO</td><td>Practical work</td><td></td><td>NO</td><td>(other)</td><td></td><td>NO</td></tr>
<tr><td>Project</td><td></td><td>NO</td><td>Written exam</td><td>YES</td><td></td><td>ECTS (total)</td><td>6</td><td></td><td>Project</td><td></td><td>NO</td><td>Written exam</td><td>YES</td><td></td><td>ECTS (total)</td><td>5</td><td></td></tr>
<tr><td colspan="8"></td><td colspan="8"></td></tr>
<tr><td rowspan="4">2.10. Required literature (available in the library and/or via other media)</td><td colspan="3">Title</td><td>Number of copies in the library</td><td colspan="4">Availability via other media</td><td colspan="3">Title</td><td>Number of copies in the library</td><td colspan="4">Availability via other media</td></tr>
<tr><td colspan="3">Bucković, B. (2006): E-Book: Historijska Geologija 1, Udžbenici Sveučilišta u Zagrebu - Manualia universitatis studiorum Zagrabiensis, 110 p.</td><td>NO</td><td colspan="4">YES</td><td colspan="3">Bucković, B. (2006): E-Book: Historijska Geologija 1, Udžbenici Sveučilišta u Zagrebu - Manualia universitatis studiorum Zagrabiensis, 110 p.</td><td>NO</td><td colspan="4">YES</td></tr>
<tr><td colspan="3"></td><td></td><td colspan="4"></td><td colspan="3"></td><td></td><td colspan="4"></td></tr>
<tr><td colspan="3"></td><td></td><td colspan="4"></td><td colspan="3"></td><td></td><td colspan="4"></td></tr>
<tr><td>2.11. Optional literature</td><td colspan="8">Stanley, S.M. (1989): Earth and Life Through Time, W. H. Freeman and Co., 689 p.
Wicander, R. Monroe, J.S. (1989): Historical Geology – Evolution of the Earth and Life Through Time, West Publishing Co., 577 p.
Herak, M. (1990): Geologija, Školska knjiga, Zagreb, 450 p.</td><td colspan="8">Stanley, S.M. (1989): Earth and Life Through Time, W. H. Freeman and Co., 689 p.
Wicander, R. Monroe, J.S. (1989): Historical Geology – Evolution of the Earth and Life Through Time, West Publishing Co., 577 p.
Herak, M. (1990): Geologija, Školska knjiga, Zagreb, 450 p.</td></tr>
</table>

DESCRIPTION OF AMENDMENTS AND MODIFICATIONS TO UNDERGRADUATE, GRADUATE AND INTEGRATED UNDERGRADUATE AND GRADUATE STUDY PROGRAMMES

Table 2B Description of the course that was amended and/or modified – Mineral Optics

1. COURSE DECRIPTION – GENERAL INFORMATION		
	Before the modification	**After the modification**
1.1. Course teacher	Assistant Professor Frane Marković, PhD	Assistant Professor Frane Marković, PhD
1.2. Name of the course	Mineral Optics	Mineral Optics
1.3. Associate teachers		
1.4. Study programme (undergraduate, graduate, integrated)	Undergraduate	Undergraduate
1.5. Status of the course	Mandatory	Mandatory
1.6. Year of the study	2nd	2nd
1.7. ECTS credits	5	5
1.8. Type of instruction (number of hours L + E + S + e-learning)	90 + 180 + 0 + 0	90 + 180 + 0 + 0
1.9. Expected enrolment in the course	35	35
1.10. Level of application of e-learning (level 1, 2, 3), percentage of online instruction (max. 20%)	Level 1, 0 %	Level 1, 0 %
2.1. Course objectives	Training students to work with a polarizing microscope, observing and recognizing the optical properties of minerals, recognizing and determining selected petrogenic minerals, acquiring relevant knowledge and skills for independent research work with a polarizing microscope	**Acquaintance of students with work on a polarizing microscope, recognition of the optical properties of the most common petrogenic minerals and their identification and differentiation in thin sections**
2.2. Course enrolment requirements and/or entry competences required for the course	Passed: General Mineralogy Passed: System of Mineralogy	Passed: General Mineralogy Passed: System of Mineralogy
2.3. Learning outcomes at the level of the programme to which		**1) Recognise and apply basic and specific knowledge related to the fundamental laws of natural science in the interpretation of geological processes.**

DESCRIPTION OF AMENDMENTS AND MODIFICATIONS TO UNDERGRADUATE, GRADUATE AND INTEGRATED UNDERGRADUATE AND GRADUATE STUDY PROGRAMMES

the course contributes		**2) Identify basic geological processes and geological materials, and connect them with the development of life on Earth and Earth itself.** **3) Select and use suitable geological methods and specific technologies in solving geological problems.** **4) Use geological maps, domestic and foreign literature and databases, as well as other sources of information.**
2.4. Expected learning outcomes at the level of the course (3-10 learning outcomes)		**1) Use a polarizing microscope to recognize the optical properties of basic petrogenic minerals** **2) Compare the recognized optical properties with literature data** **3) Identify and differentiate individual petrogenic minerals**
2.5. Course content (syllabus)	1) Nature of light, reflection and refraction of light, index of refraction, optically isotropic and anisotropic crystals, birefringence, optical indicatrix, polarization of light, polarisation microscope, thin sections 2) Orthoscopic examinations without analyser: relief, Becke's line, colour, pleochroism, pseudoabsorption 3) Orthoscopic examinations with analyser: extinction (parallel, symmetrical, oblique), interference colors, determination of the vibration direction of the polarizer, use of the accessory plates, determination of the vibration direction of the faster and slower wave, sign of elongation 4) Conoscopic examinations: conoscopic figure for optically uniaxial and optically biaxial minerals, optical character, determination of optic angle, optic axes angle dispersion 5) Optical properties of isotropic minerals: spinels, garnets, leucite 6) Optical properties of uniaxial anisotropic minerals: quartz, calcite, tourmaline 7) Optical properties of biaxial anisotropic minerals: olivines and serpentines 8) Optical properties of biaxial anisotropic minerals: ortho- and clinopyroxenes 9) Optical properties of biaxial anisotropic minerals: amphiboles (tremolite-actinolite series, hornblende, glaucophane)	**1) Nature of light, division of minerals according to optical properties, optical indicatrix, polarizing microscope** **2) Observation of minerals under orthoscopic conditions without the analyzer** **3) Observation of minerals under orthoscopic conditions with the analyzer** **4) Observation of minerals under conoscopic conditions** **5) Optical properties of isotropic minerals: garnets and leucite** **6) Optical properties of anisotropic uniaxial minerals: quartz, calcite and tourmaline** **7) Optical properties of anisotropic biaxial minerals: olivine and serpentine** **8) Optical properties of anisotropic biaxial minerals: pyroxenes** **9) Optical properties of anisotropic biaxial minerals: amphiboles** **10) Optical properties of anisotropic biaxial minerals: mica** **11) Optical properties of anisotropic biaxial minerals: alkali feldspar** **12) Optical properties of anisotropic biaxial minerals: plagioclase** **13) Optical properties of anisotropic biaxial minerals: epidote, zoisite and chlorites** **14) Optical properties of anisotropic biaxial minerals: anhydrite and gypsum**

DESCRIPTION OF AMENDMENTS AND MODIFICATIONS TO UNDERGRADUATE, GRADUATE AND INTEGRATED UNDERGRADUATE AND GRADUATE STUDY PROGRAMMES

<table>
<tr><td></td><td colspan="8">10) Optical properties of biaxial anisotropic minerals: mica (muscovite and biotite)
11) Optical properties of biaxial anisotropic minerals: alkali feldspar (sanidine, orthoclase, microcline)
12) Optical properties of biaxial anisotropic minerals: plagioclase
13) Optical properties of biaxial anisotropic minerals: chlorites, epidote
14) Optical properties of biaxial anisotropic minerals: gypsum and anhydrite
15) Opaque minerals</td><td colspan="9">15) Optical properties of anisotropic biaxial minerals: andalusite, sillimanite and kyanite</td></tr>
<tr><td>2.6. Format of instruction:</td><td colspan="4">☒ lectures
☐ seminars and workshops
☒ exercises
☐ online in entirety
☐ partial e-learning
☐ field work</td><td colspan="4">☐ independent assignments
☐ multimedia and the internet
☐ laboratory
☐ work with mentor
☐ (other)</td><td colspan="4">☒ lectures
☐ seminars and workshops
☒ exercises
☐ online in entirety
☐ partial e-learning
☐ field work</td><td colspan="5">☐ independent assignments
☐ multimedia and the internet
☐ laboratory
☐ work with mentor
☐ (other)</td></tr>
<tr><td>2.7. Comments:</td><td colspan="9"></td><td colspan="9"></td></tr>
<tr><td>2.8. Student obligations</td><td colspan="9">Regular attendance of classes and preliminary exams.</td><td colspan="9">Regular attendance of classes.</td></tr>
<tr><td rowspan="5">2.9. Monitoring student work</td><td>Class attendance</td><td>YES</td><td></td><td>Research</td><td></td><td>NO</td><td>Oral exam</td><td>YES</td><td></td><td>Class attendance</td><td>YES</td><td></td><td>Research</td><td></td><td>NO</td><td>Oral exam</td><td>YES</td><td></td></tr>
<tr><td>Experimental work</td><td></td><td>NO</td><td>Report</td><td></td><td>NO</td><td>(other)</td><td></td><td>NO</td><td>Experimental work</td><td></td><td>NO</td><td>Report</td><td></td><td>NO</td><td>(other)</td><td></td><td>NO</td></tr>
<tr><td>Essay</td><td></td><td>NO</td><td>Seminar paper</td><td></td><td>NO</td><td>(other)</td><td></td><td>NO</td><td>Essay</td><td></td><td>NO</td><td>Seminar paper</td><td></td><td>NO</td><td>(other)</td><td></td><td>NO</td></tr>
<tr><td>Preliminary exam</td><td>YES</td><td></td><td>Practical work</td><td>YES</td><td></td><td>(other)</td><td></td><td>NO</td><td>Preliminary exam</td><td>YES</td><td></td><td>Practical work</td><td>YES</td><td></td><td>(other)</td><td></td><td>NO</td></tr>
<tr><td>Project</td><td></td><td>NO</td><td>Written exam</td><td>YES</td><td></td><td>ECTS (total)</td><td colspan="2">5</td><td>Project</td><td></td><td>NO</td><td>Written exam</td><td>YES</td><td></td><td>ECTS (total)</td><td colspan="2">5</td></tr>
<tr><td rowspan="2">2.10. Required literature (available in the library and/or via other media)</td><td colspan="4">Title</td><td colspan="2">Number of copies in the library</td><td>Availability via other media</td><td colspan="4">Title</td><td colspan="3">Number of copies in the library</td><td>Availability via other media</td></tr>
<tr><td colspan="4">Barić, Lj., Tajder, M. (1967): Mikrofiziografija petrogenih minerala, Školska knjiga, Zagreb, 235 p.</td><td colspan="2">YES</td><td>NO</td><td colspan="4">Barić, Lj., Tajder, M. (1967): Mikrofiziografija petrogenih minerala, Školska knjiga, Zagreb, 235 p.</td><td colspan="3">YES</td><td>NO</td></tr>
</table>

DESCRIPTION OF AMENDMENTS AND MODIFICATIONS TO UNDERGRADUATE, GRADUATE AND INTEGRATED UNDERGRADUATE AND GRADUATE STUDY PROGRAMMES

	Međimorec, S. (1998): *Kristalna optika, interna skripta*, PMF, Zagreb	YES	NO	**Vrkljan, M., Borojević Šoštarić, S., Tomašić, N. (2018): *Optička mineralogija*, Sveučilište u Zagrebu, 331 p.**	**YES**	**NO**
	Pichler, H., Schmitt-Riegraf, C. (1987): *Gesteinsbildende Minerale im Duennschliff*, Ferdinand Enke Verlag, Stuttgart, 230 p.	YES	NO			
2.11. Optional literature	Nesse, W.D. (1991): *Introduction to Optical Mineralogy*, Oxford University Press, New York, 335 p. Wahlstrom, E.E. (1979): *Optical Crystallography, 5th ed*., John Wiley & Sons, New York, 488 p.			Nesse, W.D. (1991): *Introduction to Optical Mineralogy*, Oxford University Press, New York, 335 p. **Pichler, H., Schmitt-Riegraf, C. (1987): *Gesteinsbildende Minerale im Duennschliff*, Ferdinand Enke Verlag, Stuttgart, 230 p.** **Međimorec, S. (1998): *Kristalna optika, interna skripta*, PMF, Zagreb**		

DESCRIPTION OF AMENDMENTS AND MODIFICATIONS TO UNDERGRADUATE, GRADUATE AND INTEGRATED UNDERGRADUATE AND GRADUATE STUDY PROGRAMMES

Table 2B Description of the course that was amended and/or modified – Invertebrate Paleontology

1. COURSE DECRIPTION – GENERAL INFORMATION		
	Before the modification	**After the modification**
1.1. Course teacher	Associate Professor Đurđica Pezelj, PhD	Associate Professor Đurđica Pezelj, PhD
1.2. Name of the course	Invertebrate Paleontology	Invertebrate Paleontology
1.3. Associate teachers	Valerije Makarun, Mag. Geol.	Valerije Makarun, Mag. Geol.
1.4. Study programme (undergraduate, graduate, integrated)	Undergraduate	Undergraduate
1.5. Status of the course	Mandatory	Mandatory
1.6. Year of the study	2nd	2nd
1.7. ECTS credits	4	4
1.8. Type of instruction (number of hours L + E + S + e-learning)	30 + 15 + 0 + 0	30 + 15 + 0 + 0
1.9. Expected enrolment in the course	30 – 35	**25 – 30**
1.10. Level of application of e-learning (level 1, 2, 3), percentage of online instruction (max. 20%)		**Level 1, 2 %**
2.1. Course objectives	Description and classification of various fossil invertebrate groups. Acquaint students with their skeletal structure, paleoecological requirements and evolutionary trends through the geological past. The importance of fossil invertebrates for determining the age of deposits and for the reconstruction of paleoenvironments.	Description and classification of various fossil invertebrate groups. Acquaint students with their skeletal structure, paleoecological requirements and evolutionary trends through the geological past. The importance of fossil invertebrates for determining the age of deposits and for the reconstruction of paleoenvironments.
2.2. Course enrolment requirements and/or entry competences required for the course	Passed exams from the courses General Paleontology and Physical Geology.	Passed exams from the courses General Paleontology and Physical Geology.
2.3. Learning outcomes at the level of the programme to which	Learn to recognize the main groups of fossil invertebrates and associate them with geological periods.	**2) Identify basic geological processes and geological materials, and connect them with the development of life on Earth and Earth itself.**

DESCRIPTION OF AMENDMENTS AND MODIFICATIONS TO UNDERGRADUATE, GRADUATE AND INTEGRATED UNDERGRADUATE AND GRADUATE STUDY PROGRAMMES

<table>
<tr><td>the course contributes</td><td colspan="2"></td><td colspan="2">6) Perform relevant experiments and analyses independently or in a group and present data using suitable qualitative and quantitative methods.
12) Communicate and discuss ideas and solutions of geological problems with colleagues and experts.</td></tr>
<tr><td>2.4. Expected learning outcomes at the level of the course (3-10 learning outcomes)</td><td colspan="2">Taxonomic determination of fossil invertebrates and their interpretation (paleoecology, biostratigraphy, evolution)</td><td colspan="2">1) Recognize the main groups of fossil invertebrates and relate them to geological periods.
2) Define and identify the skeletal structure of invertebrates and, based on this, recognize them in fossil deposits and classify them taxonomically.
3) Interpret fossil invertebrates according to the rules of paleoecology, biostratigraphy and evolution.</td></tr>
<tr><td>2.5. Course content (syllabus)</td><td colspan="2">1) Introduction to the fossil invertebrates. Classification and their stratigraphic ranges
2) Parazoa: Porifera, Stromatoporoidea, Archaeocyatha
3) Cnidaria: Anthozoa
4) Cnidaria: Hydrozoa, Scyphozoa, Conularida, Cubozoa
5) Mollusca: Polyplacophora, Monoplacophora, Scaphopoda, Bivalvia I
6) Mollusca: Bivalvia II
7) Mollusca: Gastropoda
8) Mollusca: Cephalopoda with an external skeleton - nautilids, ammonites
9) Mollusca: Cephalopoda with an internal skeleton - belemnites, cuttlefish, squids, octopuses
10) Annelida, Bryozoa
11) Brachiopoda
12) Arthropoda: Trilobitomorpha
13) Arthropoda: Crustacea, Chelicerata, Tracheata
14) Echinodermata: Crinoidea, Blastoidea, Ophiuroidea, Asteroidea, Holothuroidea
15) Echinodermata: Echinoidea, Hemichordata</td><td colspan="2">1) Introduction to the fossil invertebrates. Classification and their stratigraphic ranges
2) Parazoa: Porifera, Stromatoporoidea, Archaeocyatha
3) Cnidaria: Anthozoa
4) Cnidaria: Hydrozoa, Scyphozoa, Conularida, Cubozoa
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15) Echinodermata: Echinoidea, Hemichordata</td></tr>
<tr><td>2.6. Format of instruction:</td><td>☒ lectures
☐ seminars and workshops
☒ exercises
☐ online in entirety
☐ partial e-learning</td><td>☒ independent assignments
☐ multimedia and the internet
☐ laboratory</td><td>☒ lectures
☐ seminars and workshops
☒ exercises
☐ online in entirety
☐ partial e-learning</td><td>☒ independent assignments
☐ multimedia and the internet
☐ laboratory</td></tr>
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DESCRIPTION OF AMENDMENTS AND MODIFICATIONS TO UNDERGRADUATE, GRADUATE AND INTEGRATED UNDERGRADUATE AND GRADUATE STUDY PROGRAMMES

<table>
<tr><td></td><td colspan="9">☐ field work ☐ work with mentor ☐ (other)</td><td colspan="9">☐ field work ☐ work with mentor ☐ (other)</td></tr>
<tr><td>2.7. Comments:</td><td colspan="9"></td><td colspan="9"></td></tr>
<tr><td>2.8. Student obligations</td><td colspan="9">Class attendance and passing preliminary exams</td><td colspan="9">Class attendance and passing preliminary exams</td></tr>
<tr><td rowspan="5">2.9. Monitoring student work</td><td>Class attendance</td><td>YES</td><td></td><td>Research</td><td></td><td>NO</td><td>Oral exam</td><td>YES</td><td></td><td>Class attendance</td><td>YES</td><td></td><td>Research</td><td></td><td>NO</td><td>Oral exam</td><td>YES</td><td></td></tr>
<tr><td>Experimental work</td><td></td><td>NO</td><td>Report</td><td></td><td>NO</td><td>(other)</td><td></td><td>NO</td><td>Experimental work</td><td></td><td>NO</td><td>Report</td><td></td><td>NO</td><td>(other)</td><td></td><td>NO</td></tr>
<tr><td>Essay</td><td></td><td>NO</td><td>Seminar paper</td><td></td><td>NO</td><td>(other)</td><td></td><td>NO</td><td>Essay</td><td></td><td>NO</td><td>Seminar paper</td><td></td><td>NO</td><td>(other)</td><td></td><td>NO</td></tr>
<tr><td>Preliminary exam</td><td>YES</td><td></td><td>Practical work</td><td>YES</td><td></td><td>(other)</td><td></td><td>NO</td><td>Preliminary exam</td><td>YES</td><td></td><td>Practical work</td><td>YES</td><td></td><td>(other)</td><td></td><td>NO</td></tr>
<tr><td>Project</td><td></td><td>NO</td><td>Written exam</td><td>YES</td><td></td><td>ECTS (total)</td><td colspan="2">4</td><td>Project</td><td></td><td>NO</td><td>Written exam</td><td>YES</td><td></td><td>ECTS (total)</td><td colspan="2">4</td></tr>
<tr><td rowspan="4">2.10. Required literature (available in the library and/or via other media)</td><td colspan="3">Title</td><td colspan="2">Number of copies in the library</td><td colspan="2">Availability via other media</td><td colspan="3">Title</td><td colspan="2">Number of copies in the library</td><td colspan="2">Availability via other media</td></tr>
<tr><td colspan="3">Prothero, D.R. (2003): Bringing Fossils to Life: An Introduction to Paleobiology, Wcb/McGraw-Hill, New York</td><td colspan="2">YES</td><td colspan="2">NO</td><td colspan="3">Prothero, D.R. (2003): Bringing Fossils to Life: An Introduction to Paleobiology, Wcb/McGraw-Hill, New York</td><td colspan="2">YES</td><td colspan="2">NO</td></tr>
<tr><td colspan="3">Chernicoff, S. Fox, H.A., Tanner, L.H. (2002): Earth: Geologic Principles and History, Houghton Mifflin Com. Boston, New York</td><td colspan="2">YES</td><td colspan="2">NO</td><td colspan="3">Chernicoff, S. Fox, H.A., Tanner, L.H. (2002): Earth: Geologic Principles and History, Houghton Mifflin Com. Boston, New York</td><td colspan="2">YES</td><td colspan="2">NO</td></tr>
<tr><td colspan="3">Sremac, J. (1999): Opća paleontologija, Skripta, PMF, Zagreb</td><td colspan="2">YES</td><td colspan="2">NO</td><td colspan="3">Taylor, P.D., Lewis, D.N. (2005): Fossil Invertebrates, Harward University Press, Cambridge, Massachusetts</td><td colspan="2">YES</td><td colspan="2">NO</td></tr>
<tr><td colspan="3">Boardman, R.S. (1987): Fossil Invertebrates, Blackwell Sci. Publ., Palo Alto</td><td colspan="2"></td><td colspan="2"></td><td colspan="3"></td><td colspan="2"></td><td colspan="2"></td></tr>
<tr><td>2.11. Optional literature</td><td colspan="9">Various paleontology textbooks, recent scientific articles</td><td colspan="9">Thompson, G.R., Turk, J. (1999): Earth Science and the Environment, Harcout Brace College Publishers, Orlando McGeary, D., Plummer, C.C., Carlson, D.H. (2004): Physical Geology Earth Revealed, McGraw Hill, Boston</td></tr>
</table>

DESCRIPTION OF AMENDMENTS AND MODIFICATIONS TO UNDERGRADUATE, GRADUATE AND INTEGRATED UNDERGRADUATE AND GRADUATE STUDY PROGRAMMES

Table 2B Description of the course that was amended and/or modified – Igneous Petrology

1. COURSE DECRIPTION – GENERAL INFORMATION		
	Before the modification	**After the modification**
1.1. Course teacher	Full Professor with tenure Dražen Balen, PhD	**Associate Professor Zorica Petrinec, PhD**
1.2. Name of the course	Igneous and Metamorphic Petrology	**Igneous Petrology**
1.3. Associate teachers	Petra Schneider, mag. geol.	
1.4. Study programme (undergraduate, graduate, integrated)	Undergraduate	Undergraduate
1.5. Status of the course	Mandatory	Mandatory
1.6. Year of the study	2nd	2nd
1.7. ECTS credits	7	**4**
1.8. Type of instruction (number of hours L + E + S + e-learning)	45 + 45 + 0 + 0	**30 + 30** + 0 + 0
1.9. Expected enrolment in the course	36	36
1.10. Level of application of e-learning (level 1, 2, 3), percentage of online instruction (max. 20%)	Level 1, up to 5 %	Level 1, up to 5 %
2.1. Course objectives	Students achieve basic knowledge of igneous and metamorphic petrology needed for BSc level, i.e. classification and origin of common igneous and metamorphic rocks together with their environment and setting description. Basic knowledge includes elements of laboratory and field work.	**Students acquire basic knowledge of igneous rocks and fundamental igneous petrogenetic processes. Students develop basic skills for the independent identification, determination and classification of igneous rocks using standard petrological techniques.**
2.2. Course enrolment requirements and/or entry competences required for the course	Passed: General Mineralogy, Physical Geology, System of Mineralogy	Passed: General Mineralogy, Physical Geology, System of Mineralogy
2.3. Learning outcomes at the level of the programme to which	GL_1) Basic knowledge and understanding of the natural sciences (Physics, Chemistry, Biology, Mathematics) underlying the study of Geology	**1) Recognise and apply basic and specific knowledge related to the fundamental laws of natural science in the interpretation of geological processes.**

the course contributes	GL_2) Knowledge and understanding of the essential features, processes, materials, history and the development of the Earth and life GL_3) Basic knowledge and understanding of the key aspects and concepts of geology GL_4) Knowledge of the common terminology and nomenclature and the use of bibliography in Geosciences GL_5) An awareness of the wider spectrum of geological disciplines GL_6) Awareness and understanding of the temporal and spatial dimensions in Earth processes GL_8) Awareness of major geological paradigms, the extent of geological time and Plate Tectonics GL_9) Knowledge and understanding of the complex nature of interactions within the geosphere GL_10) Appropriate knowledge of other disciplines relevant to geology GL_11) Ability to create simple geological models GL12) Some understanding of the complexity of geological problems and the feasibility of their solution GL_15) Knowledge of appropriate solution patterns for geological problems GL_16) Basic ability to describe a solution at an abstract level GL_22) Basic ability to apply appropriate technology and use relevant methods GL_23) Ability to use simple quantitative methods and to apply them to geological problems GL_24) Basic ability to independently analyse earth materials in the field and laboratory and to describe, process, document and report the results GL_26) Basic ability to combine theory and practice to complete geological tasks GL_27) Ability to undertake literature searches, and to use data bases and other sources of information GL_28) Ability to receive and respond to a variety of information sources (e.g. textual, numerical, verbal, graphical)	**2) Identify basic geological processes and geological materials, and connect them with the development of life on Earth and Earth itself.** **7) Use geological maps, domestic and foreign literature and databases, as well as other sources of information.** **9) Independently analyse geological samples in the laboratory, write and present results of research.** **12) Communicate and discuss ideas and solutions of geological problems with colleagues and experts.** **13) Design and generate simple geological models.**

DESCRIPTION OF AMENDMENTS AND MODIFICATIONS TO UNDERGRADUATE, GRADUATE AND INTEGRATED UNDERGRADUATE AND GRADUATE STUDY PROGRAMMES

	GL_29) Ability to conduct appropriate experiments, to analyse and interpret data and draw conclusions GL_30) Basic awareness of relevant state-of-the-art technologies and their application	
2.4. Expected learning outcomes at the level of the course (3-10 learning outcomes)	1) Basic knowledge and understanding of the natural processes underlying the study of geology and igneous and metamorphic rocks genesis. 2) Knowledge and understanding of the properties of minerals in order to evaluate their role and genesis in igneous and metamorphic rocks. 3) Basic knowledge and understanding of genesis and alteration of minerals, and how they reflect environmental conditions. 4) Basic ability to apply appropriate technology and use relevant methods for research in petrology. 5) Ability to use simple quantitative methods and to apply them to geological problems. 6) Basic ability to combine theory and practice to complete geological tasks. 7) Basic awareness of relevant state-of-the-art technologies and their application. 8) Basic ability to prepare, process, interpret and present data, using appropriate qualitative and quantitative techniques and packages.	**1) Explains the structure of the Earth, the mechanisms of magma formation and evolution.** **2) Explains the dependence of mineralogy, texture and structure of igneous rocks on the conditions of their formation.** **3) Applies relevant classification principles and schemes for the identification of igneous rocks.** **4) Explains binary and ternary phase diagrams used in igneous petrology.** **5) Explains the relationship between of igneous rock associations and plate tectonic processes.** **6) Independently identifies mineral phases and their abundance in igneous rock samples.** **7) Writes reports on the observations made on igneous rock specimens.** **8) Reconstructs the history of an igneous rock based on its mineralogical, structural and textural characteristics.** **9) Uses basic petrological literature with understanding.**
2.5. Course content (syllabus)	1) Rock forming minerals, structure, texture, mode of occurrence. Intrusive, vein and extrusive rocks. Pyroclastic rocks. 2) Earth mineral and chemical composition, magma, macro-, micro- and trace-elements, mineral mode and norms, variation diagrams, magmatic series. 3) Classification of igneous rocks. Volcanoes. 4) Magma origin and evolution. Magma emplacement and relative age. Magma crystallization and differentiation, crystallization and melting in binary and ternary systems. Influence of different geological factors on crystallization process. Partial melting.	**1) Basic concepts: structure of the Earth, data sources, pressure and temperature changes at depth, igneous activity as part of the rock cycle.** **2) Physical and chemical properties of magma. Polymerisation. The role of volatiles. Igneous cycle.** **3) General anatomy of a volcanic system from source to surface. Forms of igneous bodies. Volcanism.** **4) Igneous rock forming minerals. Textures and structures. Mineralogical classification systems.** **5) Hybrid and chemical classifications. Application of geochemical data. Igneous rock series.** **6) Thermodynamics in igneous systems. Phase diagrams, melting and crystallisation of magmas.**

DESCRIPTION OF AMENDMENTS AND MODIFICATIONS TO UNDERGRADUATE, GRADUATE AND INTEGRATED UNDERGRADUATE AND GRADUATE STUDY PROGRAMMES

<table>
<tr><td></td><td colspan="2">5) Igneous rocks associations, plate tectonic in magmatic cycle.
6) Mantle, meteorites, petrology of terrestrial planets and satellites. Magmatism on the active and passive continental margins.
7) Igneous rocks of divergent plate margins, rift, oceanic crust, upper mantle. Volcanism inside oceanic plates, hot-spots, layered mafic intrusions, continental alkalic magmatism, anorthosites.
8) Igneous rocks of convergent margins, island arc, continental magmatic arc, ophiolite suite. Plate (continental-continental) collision, granite.
9) Metamorphism, limits, factors, grade.
10) Type and classification of metamorphism. Prograde and retrograde metamorphism.
11) Protoliths and chemical composition of metamorphic rocks. Rock forming minerals, textures and structures of metamorphic rocks. Classifications - scheme and recommendations.
12) Influence of pressure, temperature and fluids on the mineral assemblage. Metamorphic isograds, facies and facies series. Metamorphic belts.
13) Thermal, cataclastic, regional, sea floor, burial, impact, polyphase metamorphism.
14) Geotectonic settings of metamorphism.
15) Application of equlibrium concepts to metamorphic rocks, geotermobarometry basics, age of metamorphism, P-T-t reaction paths.</td><td colspan="2">7) The mantle as the source of basaltic magmas. Melting mechanisms of the mantle in relation to geotectonic setting. Partial melting.
8) Processes that influence the primary composition of magma: differentiation, assimilation, mixing.
9) Igneous activity at divergent plate boundaries. Processes associated with mid-ocean ridges. Formation, structure and composition of the oceanic crust.
10) Igneous activity at convergent plate boundaries I. Anatomy of the subduction zone. Subduction-related processes. The role of subduction zones in the generation and evolution of the Earth’s crust.
11) Igneous activity at convergent plate boundaries II. Ocean island arcs. Volcanic arcs.
12) Igneous activity in collisional settings.
13) Granites. Classification. Modes of occurrence.
14) Within-plate igneous activity. Oceanic islands. Basaltic provinces.
15) Continental rifts. Alkaline magmatism within plates.</td></tr>
<tr><td>2.6. Format of instruction:</td><td>☒ lectures
☐ seminars and workshops
☒ exercises
☐ online in entirety
☐ partial e-learning
☐ field work</td><td>☐ independent assignments
☐ multimedia and the internet
☐ laboratory
☐ work with mentor
☐ (other)</td><td>☒ lectures
☐ seminars and workshops
☒ exercises
☐ online in entirety
☐ partial e-learning
☐ field work</td><td>☐ independent assignments
☐ multimedia and the internet
☐ laboratory
☐ work with mentor
☐ (other)</td></tr>
<tr><td>2.7. Comments:</td><td colspan="2"></td><td colspan="2">The replacement of the existing course Igneous and Metamorphic Petrology with two courses Igneous Petrology and</td></tr>
</table>

DESCRIPTION OF AMENDMENTS AND MODIFICATIONS TO UNDERGRADUATE, GRADUATE AND INTEGRATED UNDERGRADUATE AND GRADUATE STUDY PROGRAMMES

<table>
<tr><td></td><td colspan="9"></td><td colspan="9">Metamorphic Petrology is requested, because of better organisation and sequence of course materials. Accordingly, the distribution of the ECTS points is requested: 4 ECTS for course Igneous Petrology and 4 ECTS for course Metamorphic Petrology.</td></tr>
<tr><td>2.8. Student obligations</td><td colspan="9">Fulfilment of obligations.</td><td colspan="9">Regular attendance of lectures and exercises. Midterm exams.</td></tr>
<tr><td rowspan="5">2.9. Monitoring student work</td><td>Class attendance</td><td>YES</td><td></td><td>Research</td><td></td><td>NO</td><td>Oral exam</td><td>YES</td><td></td><td>Class attendance</td><td>YES</td><td></td><td>Research</td><td></td><td>NO</td><td>Oral exam</td><td>YES</td><td></td></tr>
<tr><td>Experimental work</td><td></td><td>NO</td><td>Report</td><td></td><td>NO</td><td>(other)</td><td></td><td>NO</td><td>Experimental work</td><td></td><td>NO</td><td>Report</td><td></td><td>NO</td><td>(other)</td><td></td><td>NO</td></tr>
<tr><td>Essay</td><td></td><td>NO</td><td>Seminar paper</td><td></td><td>NO</td><td>(other)</td><td></td><td>NO</td><td>Essay</td><td></td><td>NO</td><td>Seminar paper</td><td></td><td>NO</td><td>(other)</td><td></td><td>NO</td></tr>
<tr><td>Preliminary exam</td><td>YES</td><td></td><td>Practical work</td><td>YES</td><td></td><td>(other)</td><td></td><td>NO</td><td>Preliminary exam</td><td>YES</td><td></td><td>Practical work</td><td>YES</td><td></td><td>(other)</td><td></td><td>NO</td></tr>
<tr><td>Project</td><td></td><td>NO</td><td>Written exam</td><td>YES</td><td></td><td>ECTS (total)</td><td>7</td><td></td><td>Project</td><td></td><td>NO</td><td>Written exam</td><td></td><td>NO</td><td>ECTS (total)</td><td>4</td><td></td></tr>
<tr><td rowspan="4">2.10. Required literature (available in the library and/or via other media)</td><td colspan="3">Title</td><td>Number of copies in the library</td><td colspan="2">Availability via other media</td><td colspan="3">Title</td><td colspan="2">Number of copies in the library</td><td colspan="2">Availability via other media</td></tr>
<tr><td colspan="3">Best, M.G. (2003): Igneous and metamorphic petrology, Blackwell Publishing, 729 p.</td><td>YES</td><td colspan="2">YES</td><td colspan="3">Best, M.G. (2003): Igneous and metamorphic petrology, Blackwell Publishing, 729 p.</td><td colspan="2">YES</td><td colspan="2">YES</td></tr>
<tr><td colspan="3">Blatt, H., Tracy, R.J. (1996): Petrology. Igneous, Sedimentary and Metamorphic, W.H. Freeman and co., 529 p.</td><td>YES</td><td colspan="2">NO</td><td colspan="3"></td><td colspan="2"></td><td colspan="2"></td></tr>
<tr><td colspan="3"></td><td></td><td colspan="2"></td><td colspan="3"></td><td colspan="2"></td><td colspan="2"></td></tr>
<tr><td>2.11. Optional literature</td><td colspan="9">Hyndman, D.W. (1985): Petrology of Igneous and Metamorphic Rocks, McGraw Hill Inc., N. Y., 786 p.

Thorpe, R., Brown, G. (1996): The field description of igneous rocks, John Wiley & Sons, 154 p.

Fry, N. (1996): The field description of metamorphic rocks, John Wiley & Sons, 111 p.</td><td colspan="9">Gill, G. (2010): Igneous Rocks and Processes: A Practical Guide, Wiley-Blackwell, 428 p.

Klein, C., Phillpots, A. (2016): Earth Materials, Cambridge University Press, 616 p.</td></tr>
</table>

DESCRIPTION OF AMENDMENTS AND MODIFICATIONS TO UNDERGRADUATE, GRADUATE AND INTEGRATED UNDERGRADUATE AND GRADUATE STUDY PROGRAMMES

Table 2B Description of the course that was amended and/or modified – Micropaleontology

1. COURSE DECRIPTION – GENERAL INFORMATION		
	Before the modification	**After the modification**
1.1. Course teacher	Full Professor with tenure Vlasta Ćosović, PhD	**Associate Professor Đurđica Pezelj, PhD**
1.2. Name of the course	Micropaleontology I	**Micropaleontology**
1.3. Associate teachers	Igor Pejnović, Mag. Geol.	Igor Pejnović, Mag. Geol.
1.4. Study programme (undergraduate, graduate, integrated)	Undergraduate	Undergraduate
1.5. Status of the course	Mandatory	Mandatory
1.6. Year of the study	2nd	2nd
1.7. ECTS credits	3	3
1.8. Type of instruction (number of hours L + E + S + e-learning)	15 + 30 + 0 + 0	15 + 30 + 0 + 0
1.9. Expected enrolment in the course		36
1.10. Level of application of e-learning (level 1, 2, 3), percentage of online instruction (max. 20%)	Level 1, up to 3 %	Level 1, up to 3 %
2.1. Course objectives	Introduction to the basic concepts, principles and applications of microfossils.	Introduction to the basic concepts, principles and applications of microfossils.
2.2. Course enrolment requirements and/or entry competences required for the course	Passed the Physical Geology exam Passed the General Paleontology exam	Passed the Physical Geology exam Passed the General Paleontology exam
2.3. Learning outcomes at the level of the programme to which the course contributes	1. Basic knowledge and understanding of the natural sciences (Physics, Chemistry, Biology, Mathematics) underlying the study of Geology 3. Basic knowledge and understanding of the key aspects and concepts of geology	**1) Recognise and apply basic and specific knowledge related to the fundamental laws of natural science in the interpretation of geological processes.** **2) Identify basic geological processes and geological materials and connect them with the development of life on Earth and Earth itself.**

DESCRIPTION OF AMENDMENTS AND MODIFICATIONS TO UNDERGRADUATE, GRADUATE AND INTEGRATED UNDERGRADUATE AND GRADUATE STUDY PROGRAMMES

	4. Knowledge of the common terminology and nomenclature and the use of bibliography in Geosciences 5. An awareness of the wider spectrum of geological disciplines 6. Awareness and understanding of the temporal and spatial dimensions in Earth processes 7. Awareness of the applications and responsibilities of Geology and its role in society including its environmental aspects 10. Appropriate knowledge of other disciplines relevant to geology 11. Ability to create simple geological models 12. Some understanding of the complexity of geological problems and the feasibility of their solution 14. Basic ability in the formalization and specification of problems whose solution involves the use of geological methods 15. Knowledge of appropriate solution patterns for geological problems 16. Basic ability to describe a solution at an abstract level 17. Knowledge of the range of applications of Geology 18. Ability to integrate field and laboratory evidence with theory following the sequence from observation to recognition, synthesis and modelling 19. Appreciation of issues concerning sample selection, accuracy, precision and uncertainty during collection, recording and analysis of data in the field and laboratory 20. Ability to formulate and test hypotheses 21. Basic ability to become familiar with new geological methods and technologies 22. Basic ability to apply appropriate technology and use relevant methods 23. Ability to use simple quantitative methods and to apply them to geological problems 26. Basic ability to combine theory and practice to complete geological tasks 28. Ability to receive and respond to a variety of information sources (e.g. textual, numerical, verbal, graphical) 29. Ability to conduct appropriate experiments, to analyze and interpret data and draw conclusions	**3) Identify simple geological problems and suggest possible solutions.** **4) Select and use suitable geological methods and specific technologies in solving geological problems.** **10) Identify problems related to sampling and data processing in field and laboratory research.** **13) Design and generate simple geological models.**

DESCRIPTION OF AMENDMENTS AND MODIFICATIONS TO UNDERGRADUATE, GRADUATE AND INTEGRATED UNDERGRADUATE AND GRADUATE STUDY PROGRAMMES

	35. Ability to work effectively as an individual and as a member of a team 36. Recognition of the need for, and engagement in self-managed and life-long learning 37. Ability to organise their own work independently 39. Basic ability to prepare, process, interpret and present data, using appropriate qualitative and quantitative techniques and packages	
2.4. Expected learning outcomes at the level of the course (3-10 learning outcomes)		**1) Be able to select the appropriate methods for processing samples with microfossils in the laboratory.** **2) Apply basic research methods in micropaleontology.** **3) Be able to identify selected groups of microfossils.** **4) Apply the basics of natural systematics and be able to classify which group each category of microfossil belongs to.** **5) Describe and demonstrate the interpretation of past environments based on the composition of microfossil assemblages.** **6) Be able to apply analytical methods to define the basic concepts of paleoecology and paleoclimatology.** **7) Understand a range of dating methods used in micropaleontology.**
2.5. Course content (syllabus)	1) A brief historical overview of micropaleontology. 2) Sampling and preparation methods, optical methods, and possibilities of studying microfossils. 3) Morphology, systematics and life-strategy of foraminifera. 4) Planktonic and smaller benthic foraminifera. 5) Larger benthic foraminifera. 6) Blue-green algae and red algae: Systematics, morphology, age-interpretation. 7) Green algae: Systematics, morphology, age-interpretation. 8) Nannofossils: Classification, morphology 9) Palynomorphs 10) Ostracods, conodonts and pteropods. 11) Radiolarians and conodonts. 12) Remains of macrofossils	**1) Micropaleontology, what is it? Sampling methods and laboratory processing of samples.** **2) Foraminifera, basic concepts.** **3) Planktonic foraminifera: Morphology and wall structures, evolution, and application.** **4) Smaller benthic foraminifera: Morphology, evolution, and application.** **5) Larger benthic foraminifera (I): complex structure and oriented sections (genera of the Palaeozoic and Mesozoic).** **6) Larger benthic foraminifera (II): Complex structure and oriented sections of tests (Cenozoic genera).** **7) Application of foraminifera in biostratigraphy, paleoecology (paleoclimatology).** **8) Chrysophyceae (golden-brown algae): Morphology, evolution, and application.**

DESCRIPTION OF AMENDMENTS AND MODIFICATIONS TO UNDERGRADUATE, GRADUATE AND INTEGRATED UNDERGRADUATE AND GRADUATE STUDY PROGRAMMES

	13) The importance of microfossils in biostratigraphy, paleoecology and oil exploration.	**9) Algae with the skeletons (I): blue-green algae and red algae.** **10) Algae with the skeletons (II): Green algae.** **11) Basics of palynology: spores and pollen, dinoflagellates.** **12) Zooplankton: radiolarians, calpionellidae.** **13) Ostracods and conodonts: Basic concepts and application.**
2.6. Format of instruction:	☒ lectures ☐ seminars and workshops ☒ exercises ☐ online in entirety ☐ partial e-learning ☐ field work ☒ independent assignments ☐ multimedia and the internet ☒ laboratory ☐ work with mentor ☐ (other)	☒ lectures ☒ **seminars and workshops** ☒ exercises ☐ online in entirety ☐ partial e-learning ☐ field work ☒ independent assignments ☐ multimedia and the internet ☒ laboratory ☐ work with mentor ☐ (other)
2.7. Comments:		
2.8. Student obligations		**Attending classes and passing colloquia.**

2.9. Monitoring student work

Class attendance	YES		Research		NO	Oral exam	YES		Class attendance	YES		Research		NO	Oral exam	YES	
Experimental work	YES		Report		NO	(other)		NO	Experimental work	YES		Report		NO	(other)		NO
Essay	YES		Seminar paper		NO	(other)		NO	Essay		**NO**	Seminar paper		NO	(other)		NO
Preliminary exam	YES		Practical work	YES		(other)		NO	Preliminary exam	YES		Practical work	YES		(other)		NO
Project		NO	Written exam	YES		ECTS (total)	3		Project		NO	Written exam	YES		ECTS (total)	3	

2.10. Required literature (available in the library and/or via other media)

Title	**Number of copies in the library**	**Availability via other media**	**Title**	**Number of copies in the library**	**Availability via other media**
Haq, B.U., Boersma, A. (1998): *Introduction to Marine Micropaleontology,* Elsevier, New York	YES	NO	**Amstrong, H. Brasier, M. (2005): *Microfossils*, Blackwell Publishing**	**YES**	**YES**
Bignot, G. (1985): *Elements of Micropaleontology* Graham & Trotman Ltm., London	YES	YES	**Saraswati, P.K. Srinivasan, M.S. (2016): *Micropaleontology, Principles and Applications,* Springer Publications**	**YES**	**NO**

DESCRIPTION OF AMENDMENTS AND MODIFICATIONS TO UNDERGRADUATE, GRADUATE AND INTEGRATED UNDERGRADUATE AND GRADUATE STUDY PROGRAMMES

	Riding, R. (1991): *Calcareous Algae and Stromatolites,* Springer Verlag, Berlin	YES	NO	**Dan Gregorescu, D. (2021): *Introduction to Microfossil Biostratigraphy,* Cambridge Scholars Publishing**	**NO**	**YES**
				Haslett, S.K. (ur) (2002): *Quaternary Environmental micropaleontology,* Hodder Educ. Publ.	**YES**	**YES**
2.11. Optional literature				**Haq, B.U., Boersma, A. (1998): *Introduction to Marine Micropaleontology,* Elsevier, New York** **Bignot, G. (1985): *Elements of Micropaleontology,* Graham & Trotman Ltm., London**		

DESCRIPTION OF AMENDMENTS AND MODIFICATIONS TO UNDERGRADUATE, GRADUATE AND INTEGRATED UNDERGRADUATE AND GRADUATE STUDY PROGRAMMES

Table 2B Description of the course that was amended and/or modified – Geochemistry

1. COURSE DECRIPTION – GENERAL INFORMATION		
	Before the modification	**After the modification**
1.1. Course teacher	Associate Professor Hana Fajković, PhD	Associate Professor Hana Fajković, PhD
1.2. Name of the course	Geochemistry	Geochemistry
1.3. Associate teachers		
1.4. Study programme (undergraduate, graduate, integrated)	Undergraduate	Undergraduate
1.5. Status of the course	Mandatory	Mandatory
1.6. Year of the study	3rd	**2nd**
1.7. ECTS credits	4	4
1.8. Type of instruction (number of hours L + E + S + e-learning)	30 + 15 + 0 + 0	30 + 15 + 0 + 0
1.9. Expected enrolment in the course	36	36
1.10. Level of application of e-learning (level 1, 2, 3), percentage of online instruction (max. 20%)	Level 1, 0 %	Level 1, 0 %
2.1. Course objectives	Introducing students to the distribution of chemical elements in the Universe, the megasystem of the Earth (the Earth's crust, mantle and core), the atmosphere, the hydrosphere and the biosphere, and the laws that condition these distributions	Introducing students with the distribution of chemical elements in the Universe, in the Earth system (Earth's crust, mantle and core), atmosphere, hydrosphere and biosphere and the laws that condition these distributions
2.2. Course enrolment requirements and/or entry competences required for the course	Passed courses Chemistry I and Chemistry II. Completed course Igneous and Metamorphic Petrology.	Passed courses Chemistry I and General Mineralogy. Completed courses Chemistry II and System of Mineralogy
2.3. Learning outcomes at the level of the programme to which the course contributes	1) Basic knowledge and understanding of the natural sciences (Physics, Chemistry, Biology, Mathematics) underlying the study of Geology 3) Basic knowledge and understanding of the key aspects and concepts of geology	**1) Recognise and apply basic and specific knowledge related to the fundamental laws of natural science in the interpretation of geological processes.**

DESCRIPTION OF AMENDMENTS AND MODIFICATIONS TO UNDERGRADUATE, GRADUATE AND INTEGRATED UNDERGRADUATE AND GRADUATE STUDY PROGRAMMES

	4) Knowledge of the common terminology and nomenclature and the use of bibliography in Geosciences 5) An awareness of the wider spectrum of geological disciplines 6) Awareness and understanding of the temporal and spatial dimensions in Earth processes 7) Awareness of the applications and responsibilities of Geology and its role in society including its environmental aspects 9) Knowledge and understanding of the complex nature of interactions within the geosphere 10) Appropriate knowledge of other disciplines relevant to geology 12) Some understanding of the complexity of geological problems and the feasibility of their solution 13) Understanding the need of a rational use of earth resources 15) Knowledge of appropriate solution patterns for geological problems 17) Knowledge of the range of applications of Geology 21) Basic ability to become familiar with new geological methods and technologies 23) Ability to use simple quantitative methods and to apply them to geological problems 27) Ability to undertake literature searches, and to use data bases and other sources of information 28) Ability to receive and respond to a variety of information sources (e.g. textual, numerical, verbal, graphical) 29) Ability to conduct appropriate experiments, to analyse and interpret data and draw conclusions 30) Basic awareness of relevant state-of-the-art technologies and their application 31) Basic ability to solve numerical problems using computer and non-computer-based techniques 34) Ability to learn and study including effective time management and flexibility 35) Ability to work effectively as an individual and as a member of a team 36) Recognition of the need for, and engagement in self-managed and life-long learning	**6) Perform relevant experiments and analyses independently or in a group and present data using suitable qualitative and quantitative methods** **11) Organise field and laboratory data and compare them with acquired professional knowledge** **14) Recognise the role of geology in knowledge development, valuation of goods, spatial arrangement, improvement of life quality and environmental preservation**

DESCRIPTION OF AMENDMENTS AND MODIFICATIONS TO UNDERGRADUATE, GRADUATE AND INTEGRATED UNDERGRADUATE AND GRADUATE STUDY PROGRAMMES

	37) Ability to organise their own work independently	
2.4. Expected learning outcomes at the level of the course (3-10 learning outcomes)	1) Knowledge and understanding of geochemical principles by which it is possible to 2) solve specific geological problems. 3) Basic knowledge of the occurrence, abundance and distribution of chemical elements 4) in the Universe. 5) Knowledge of the importance of trace elements in the interpretation of magmatic 6) processes. 7) Ability to explain the physicochemical mechanisms of the aqueous solutions. Ability to explain the chemistry of the hydrosphere and its role in the weathering of the major rock types. 8) Ability to understand the interconnectedness of physical, chemical, geological and 9) biological processes in the major environments on Earth	**1) Application of natural scientific laws in the interpretation of processes on Earth.** **2) The possibility of choosing the appropriate analytical method depending on the given problem.** **3) Interpretation and systematization of the results, with a conclusion on the investigated problem.** **4) Synthesizing acquired knowledge when interpreting the results.** **5) Searching and using literature.**
2.5. Course content (syllabus)	1) Definition, divisions, history and position of the geochemistry in natural sciences; 2) Fundamentals of geochemical systems, geochemical variables, termodynamics and kinetics; 3) Chemical elements, atomic quantum model, origin of elements; 4) Fundamentals of cosmology, origin, age and composition of the Universe; 5) Genesis, structure and composition of planets and other bodies of the Solar system; 6) Origin of elements, theory of nucleosyntesis; 7) The Earth megasystem, definition of geosphere, theory of Earth structure; 8) Structure and composition of the Earth crust. Average element composition of the Earth crust; 9) Structure and composition of the Earth mantle; 10) Structure and composition of the Earth core. Composition of the Earth as entity; 11) Geochemical system of the atmosphere, structure and composition of the atmosphere;	**1) Introduction - from the structure of atoms, the formation of chemical elements, the age of the Earth, the development of the atmosphere** **2) Chemical differentiation of the Earth** **3) Chemical bonds, Coordination polyhedra** **4) Normalization and geochemical calculations** **5 – 6) Geochemistry of aqueous solutions** **7 – 8) Activity and ionic strength of the solution** **9) System CaCO3 -CO2 -H2O** **10) Thermodynamics** **11 – 12) Eh-pH diagrams, stability of minerals, Voltammetry** **13) Chemical weathering** **14) Isotopes** **15) Diagrams and classifications in Geochemistry**

DESCRIPTION OF AMENDMENTS AND MODIFICATIONS TO UNDERGRADUATE, GRADUATE AND INTEGRATED UNDERGRADUATE AND GRADUATE STUDY PROGRAMMES

<table>
<tr><td></td><td colspan="8">12) The origin of variable constituents of the atmosphere, origin and evolution of the
13) atmosphere, losses and additions to the atmosphere;
14) Geochemical system of the hydrosphere, Hydrologic cycle. The composition of the atmosphere;
15) Geochemical system of oceans; Conservative and nonconservative elements in oceans;
16) Geochemical system of the biosphere. The composition of biosphere. Main processes in the biosphere</td><td colspan="8"></td></tr>
<tr><td>2.6. Format of instruction:</td><td colspan="4">☒ lectures
☐ seminars and workshops
☒ exercises
☐ online in entirety
☐ partial e-learning
☐ field work</td><td colspan="4">☐ independent assignments
☐ multimedia and the internet
☐ laboratory
☐ work with mentor
☐ (other)</td><td colspan="4">☒ lectures
☐ seminars and workshops
☒ exercises
☐ online in entirety
☐ partial e-learning
☐ field work</td><td colspan="4">☐ independent assignments
☐ multimedia and the internet
☐ laboratory
☐ work with mentor
☐ (other)</td></tr>
<tr><td>2.7. Comments:</td><td colspan="8"></td><td colspan="8">The transfer of the course from the V to the III semester is requested for a better sequence of course materials (i.e., to come before the course Elemental and Phase Analyses).</td></tr>
<tr><td>2.8. Student obligations</td><td colspan="8">Attending classes, preliminary exams, homework assignments</td><td colspan="8">Attending classes, preliminary exams, homework assignments</td></tr>
<tr><td rowspan="5">2.9. Monitoring student work</td><td>Class attendance</td><td>YES</td><td></td><td>Research</td><td></td><td>NO</td><td>Oral exam</td><td>YES</td><td></td><td>Class attendance</td><td>YES</td><td></td><td>Research</td><td></td><td>NO</td><td>Oral exam</td><td>YES</td><td></td></tr>
<tr><td>Experimental work</td><td></td><td>NO</td><td>Report</td><td></td><td>NO</td><td>(other)</td><td></td><td>NO</td><td>Experimental work</td><td></td><td>NO</td><td>Report</td><td></td><td>NO</td><td>(other)</td><td></td><td>NO</td></tr>
<tr><td>Essay</td><td></td><td>NO</td><td>Seminar paper</td><td></td><td>NO</td><td>(other)</td><td></td><td>NO</td><td>Essay</td><td></td><td>NO</td><td>Seminar paper</td><td></td><td>NO</td><td>(other)</td><td></td><td>NO</td></tr>
<tr><td>Preliminary exam</td><td>YES</td><td></td><td>Practical work</td><td></td><td>NO</td><td>(other)</td><td></td><td>NO</td><td>Preliminary exam</td><td>YES</td><td></td><td>Practical work</td><td></td><td>NO</td><td>(other)</td><td></td><td>NO</td></tr>
<tr><td>Project</td><td></td><td>NO</td><td>Written exam</td><td>YES</td><td></td><td>ECTS (total)</td><td colspan="2">4</td><td>Project</td><td></td><td>NO</td><td>Written exam</td><td>YES</td><td></td><td>ECTS (total)</td><td colspan="2">4</td></tr>
<tr><td rowspan="6">2.10. Required literature (available in the library and/or via other media)</td><td colspan="3">Title</td><td colspan="2">Number of copies in the library</td><td colspan="3">Availability via other media</td><td colspan="3">Title</td><td colspan="3">Number of copies in the library</td><td colspan="2">Availability via other media</td></tr>
<tr><td colspan="3">Prohić, E. (1998): Geokemija, Targa, 554 p.</td><td colspan="2">YES</td><td colspan="3">NO</td><td colspan="3">Prohić, E. (1998): Geokemija, Targa, 554 p.</td><td colspan="3">YES</td><td colspan="2">NO</td></tr>
<tr><td colspan="3"></td><td colspan="2"></td><td colspan="3"></td><td colspan="3"></td><td colspan="3"></td><td colspan="2"></td></tr>
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</table>

DESCRIPTION OF AMENDMENTS AND MODIFICATIONS TO UNDERGRADUATE, GRADUATE AND INTEGRATED UNDERGRADUATE AND GRADUATE STUDY PROGRAMMES

2.11. Optional literature	Richardson, M.S., McSween, Y.H.Jr. (1989): *Geochemistry - Pathways and processes,* Prentice -Hall, Inc, New Jersey, USA 500 p**.**			**Faure, G. (1998): *Principles and Applications of Geochemistry*, Prentice -Hall, Inc, New Jersey, USA 600 p.** **Misra, K.C. (2012): *Introduction to Geochemistry: Principles and Applications*, Wiley-Blackwell, Chichester, UK 452 p** **Albarède, F. (2017): *Geochemistry, An Introduction*, Cambridge, UK 342 p.**		

DESCRIPTION OF AMENDMENTS AND MODIFICATIONS TO UNDERGRADUATE, GRADUATE AND INTEGRATED UNDERGRADUATE AND GRADUATE STUDY PROGRAMMES

Table 2A Description of the new course – English Language II

1. COURSE DECRIPTION – GENERAL INFORMATION			
1.1. Course teacher	Senior Lecturer Dubravka Pleše, PhD	1.6. Year of the study	2nd and 3rd
1.2. Name of the course	English language II	1.7. ECTS credits	3
1.3. Associate teachers		1.6. Type of instruction (number of hours L + S + E + e-learning)	30 + 0 + 0 + 0
1.4. Study programme (undergraduate, graduate, integrated)	Undergraduate	1.7. Expected enrolment in the course	37
1.5. Status of the course	Elective	1.8. Level of application of e-learning (level 1, 2, 3), percentage of online instruction (max. 20%)	Level 1
2. COURSE DESCRIPTION			
2.1. Course objectives	To understand and adopt scientific and professional terminology in the field of geology. To familiarize students with geological phenomena and explain their causes and consequences in English. To encourage students to critically reflect on geological science. To expand and build students' vocabulary in the English language of the profession, as well as develop and enhance their communication skills (both oral and written) and the ability to comprehend specialized topics.		
2.2. Enrolment requirements and/or entry competences required for the course	Completed coursework and passed exam for English Language I.		
2.3. Learning outcomes at the level of the programme to which the course contributes	To recognize and apply fundamental and specific knowledge related to basic natural science principles in interpreting geological processes and learn to name these processes in the English language. To summarize and report on a specialized text that has been read. To utilize a geological map and describe what is seen in English. To recognize the role of Geology in the development of knowledge, the assessment of resources, spatial planning, improvement of quality of life, and environmental conservation. To use professional domestic and foreign literature, databases, as well as other sources of information. To communicate and justify ideas and solutions to geological problems in English with colleagues and experts.		
2.4. Expected learning outcomes at the level of the course (3-10 learning outcomes)	Students will name geological phenomena and processes in English, provide examples of these phenomena and processes, describe the processes of the formation of individual phenomena, interpret them, connect causes and consequences, and establish and compare the similarities and differences of various processes and phenomena. Students will explain the specialized text they have read in their own words in English and demonstrate their understanding of the material in the quiz.		

DESCRIPTION OF AMENDMENTS AND MODIFICATIONS TO UNDERGRADUATE, GRADUATE AND INTEGRATED UNDERGRADUATE AND GRADUATE STUDY PROGRAMMES

2.5. Course content (syllabus)	1) Introductory Session / Geologic Time 2) Plate Tectonics 3) Film Session 4) Water 5) Mass Wasting 6) Coastlines 7) Quiz (Preliminary exam) 8) Earthquakes 9) Deserts 10) Glaciers 11) Global Climate Change 12) Energy and Mineral Resources 13) Film Session 14) Quiz 15) Quiz Correction and Final Session								
2.6. Format of instruction:	☒ lectures ☐ seminars and workshops ☐ exercises ☐ online in entirety ☐ partial e-learning ☐ field work		☐ independent assignments ☐ multimedia and the internet ☐ laboratory ☐ work with mentor ☐ (other)		2.7. Comments:				
2.8. Student obligations	Attending classes.								
2.9. Monitoring student work	Class attendance	YES		Research		NO	Oral exam	YES	
	Experimental work		NO	Report		NO	(other)	YES	NO
	Essay		NO	Seminar paper		NO	(other)	YES	NO
	Preliminary exam	YES		Practical work		NO	(other)	YES	NO
	Project		NO	Written exam		NO	ECTS (total)	3	

2.10. Required literature (available in the library and/or via other media)	**Title**	**Number of copies in the library**	**Availability via other media**
	Pleše, D. (2013): *Skripta iz engleskog jezika za studente geologije*	NO	YES
	Johnson, C., Affolter, M.P., Inkenbrandt, P, Mosher, P. (2017): *An Introduction to Geology*, Salt Lake Community College.	NO	YES
2.11. Optional literature (name the title)	Compton, R.R. (2016): *Geology in the Field*, Earthspun Books		

DESCRIPTION OF AMENDMENTS AND MODIFICATIONS TO UNDERGRADUATE, GRADUATE AND INTEGRATED UNDERGRADUATE AND GRADUATE STUDY PROGRAMMES

Table 2B Description of the course that was amended and/or modified – Historical Geology II

1. COURSE DECRIPTION – GENERAL INFORMATION		
	Before the modification	**After the modification**
1.1. Course teacher	Full Professor Damir Bucković, PhD	Full Professor Damir Bucković, PhD
1.2. Name of the course	Historical Geology II	Historical Geology II
1.3. Associate teachers		
1.4. Study programme (undergraduate, graduate, integrated)	Undergraduate	Undergraduate
1.5. Status of the course	Mandatory	Mandatory
1.6. Year of the study	2nd	2nd
1.7. ECTS credits	4	**5**
1.8. Type of instruction (number of hours L + E + S + e-learning)	30 + 30 + 0 + 0	**45** + 30 + 0 + 0
1.9. Expected enrolment in the course	25	25
1.10. Level of application of e-learning (level 1, 2, 3), percentage of online instruction (max. 20%)	Level 1, 0 %	Level 1, 0 %
2.1. Course objectives	To introduce students with the spatial and temporal dynamics of the Earth during the Mesozoic and Tertiary, with the development of the living world, and with the structure and mutual relations of Mesozoic and Tertiary chronostratigraphic (rock) units that are present in the territory of the Republic of Croatia.	**Familiarity** with the spatial and temporal dynamics of the Earth during the Mesozoic and Cenozoic, with the development of the living world, and with the structure and mutual relations of Mesozoic and Cenozoic chronostratigraphic (rock) units that are present in the Republic of Croatia.
2.2. Course enrolment requirements and/or entry competences required for the course	Course in Physical Geology – passed Course in General Paleontology – passed	Course in Physical Geology – passed Course in General Paleontology – passed
2.3. Learning outcomes at the level of the programme to which		**1) Basic knowledge and understanding of the key aspects and concepts of geology.**

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the course contributes		**2) Use geological maps, domestic and foreign literature and databases, as well as other sources of information.** **3) Identify problems related to sampling and data processing in field and laboratory research.** 4) **Organise field and laboratory data and compare them with acquired professional knowledge.**
2.4. Expected learning outcomes at the level of the course (3-10 learning outcomes)		**1) Describe and discuss the processes and formation of geological materials and the development of life through the Mesozoic and/or Cenozoic.** **2) Interpret the geological structure of a Mesozoic and/or Cenozoic area based on the recognition of chronostratigraphic units on the ground and on the geological map.** **3) Identify the litho- and biofacies of the investigated Mesozoic and/or Cenozoic rocks by field sampling and sample processing in the laboratory.** **4) Interpret the geological development of the Mesozoic and/or Cenozoic researched terrain and compare it with current knowledge.**
2.5. Course content (syllabus)	1) Life and paleogeography of the Triassic 2) Continental and epicontinental developments of the Triassic 3) Tethys developments of the Triassic 4) Development of the Triassic in the Dinarides 5) Life and paleogeography of the Jurassic 6) Epicontinental developments of the Jurassic 7) Tethys developments of the Jurassic 8) Development of the Jurassic in the Dinarides 9) Life and paleogeography of the Cretaceous 10) Epicontinental and Tethys developments of the Cretaceous 11) Development of the Cretaceous in the Dinarides 12) Life in the Tertiary 13) Paleogeography and climate of the Tertiary 14) Developments of the Paleogene in Europe and in the Dinarides 15) Developments of the Neogene in the Tethys and Paratethys areas.	1) Paleogeography of the Triassic, epicontinental and Tethys sedimentary developments of the Triassic 2) Sedimentary development of the Triassic in the Dinarides 3) Life in the Triassic 4) Paleogeography of the Jurassic, epicontinental and Tethys sedimentary developments of the Jurassic 5) Sedimentary development of the Jurassic in the Dinarides **6) Life in the Jurassic** 7) Paleogeography of the Cretaceous, epicontinental and Tethys sedimentary developments of the Cretaceous 8) Sedimentary development of the Cretaceous in the Dinarides **9) Life in the Cretaceous** **10) Palaeogeography of the Paleogene** **11) Sedimentary developments of the Paleogene in Europe and the Dinarides** **12) Life in the Paleogene** **13) Paleogeography and climate of the Neogene and Quaternary**

DESCRIPTION OF AMENDMENTS AND MODIFICATIONS TO UNDERGRADUATE, GRADUATE AND INTEGRATED UNDERGRADUATE AND GRADUATE STUDY PROGRAMMES

<table>
<tr><td></td><td colspan="9"></td><td colspan="9">14) Sedimentary developments of the Neogene in the Outer Dinarides, Adriatic Basin and Paratethys
15) Life in the Neogene and Quaternary</td></tr>
<tr><td>2.6. Format of instruction:</td><td colspan="9">☒ lectures
☐ seminars and workshops
☒ exercises
☐ online in entirety
☐ partial e-learning
☒ field work
☐ independent assignments
☐ multimedia and the internet
☐ laboratory
☐ work with mentor
☐ (other)</td><td colspan="9">☒ lectures
☐ seminars and workshops
☒ exercises
☐ online in entirety
☐ partial e-learning
☒ field work
☐ independent assignments
☐ multimedia and the internet
☐ laboratory
☐ work with mentor
☐ (other)</td></tr>
<tr><td>2.7. Comments:</td><td colspan="9"></td><td colspan="9">An increase in ECTS points from 4 to 5 is requested, as well as modification of the type of instruction (a change of number of lecture hours from 30 to 45).</td></tr>
<tr><td>2.8. Student obligations</td><td colspan="9">Regular attendance of classes. Passing a written exam.</td><td colspan="9">Regular attendance of classes. Passing a written exam.</td></tr>
<tr><td>2.9. Monitoring student work</td><td colspan="9"><table>
<tr><td>Class attendance</td><td>YES</td><td></td><td>Research</td><td></td><td>NO</td><td>Oral exam</td><td></td><td>NO</td></tr>
<tr><td>Experimental work</td><td></td><td>NO</td><td>Report</td><td></td><td>NO</td><td>(other)</td><td></td><td>NO</td></tr>
<tr><td>Essay</td><td></td><td>NO</td><td>Seminar paper</td><td></td><td>NO</td><td>(other)</td><td></td><td>NO</td></tr>
<tr><td>Preliminary exam</td><td></td><td>NO</td><td>Practical work</td><td></td><td>NO</td><td>(other)</td><td></td><td>NO</td></tr>
<tr><td>Project</td><td></td><td>NO</td><td>Written exam</td><td>YES</td><td></td><td>ECTS (total)</td><td>4</td><td></td></tr>
</table></td><td colspan="9"><table>
<tr><td>Class attendance</td><td>YES</td><td></td><td>Research</td><td></td><td>NO</td><td>Oral exam</td><td></td><td>NO</td></tr>
<tr><td>Experimental work</td><td></td><td>NO</td><td>Report</td><td></td><td>NO</td><td>(other)</td><td></td><td>NO</td></tr>
<tr><td>Essay</td><td></td><td>NO</td><td>Seminar paper</td><td></td><td>NO</td><td>(other)</td><td></td><td>NO</td></tr>
<tr><td>Preliminary exam</td><td></td><td>NO</td><td>Practical work</td><td></td><td>NO</td><td>(other)</td><td></td><td>NO</td></tr>
<tr><td>Project</td><td></td><td>NO</td><td>Written exam</td><td>YES</td><td></td><td>ECTS (total)</td><td>5</td><td></td></tr>
</table></td></tr>
<tr><td>2.10. Required literature (available in the library and/or via other media)</td><td colspan="3">Title</td><td>Number of copies in the library</td><td colspan="5">Availability via other media</td><td colspan="3">Title</td><td>Number of copies in the library</td><td colspan="5">Availability via other media</td></tr>
<tr><td></td><td colspan="3">Bucković, B. (2006): E-Book: Historijska Geologija 2, Udžbenici Sveučilišta u Zagrebu - Manualia universitatis studiorum Zagrabiensis, 155 p.</td><td>NO</td><td colspan="5">YES</td><td colspan="3">Bucković, B. (2006): E-Book: Historijska Geologija 2, Udžbenici Sveučilišta u Zagrebu - Manualia universitatis studiorum Zagrabiensis, 155 p.</td><td>NO</td><td colspan="5">YES</td></tr>
<tr><td></td><td colspan="3"></td><td></td><td colspan="5"></td><td colspan="3"></td><td></td><td colspan="5"></td></tr>
<tr><td></td><td colspan="3"></td><td></td><td colspan="5"></td><td colspan="3"></td><td></td><td colspan="5"></td></tr>
<tr><td></td><td colspan="3"></td><td></td><td colspan="5"></td><td colspan="3"></td><td></td><td colspan="5"></td></tr>
</table>

DESCRIPTION OF AMENDMENTS AND MODIFICATIONS TO UNDERGRADUATE, GRADUATE AND INTEGRATED UNDERGRADUATE AND GRADUATE STUDY PROGRAMMES

2.11. Optional literature	Stanley, S.M. (1989): *Earth and Life Through Time*, W. H. Freeman and Co., 689. Wicander, R. Monroe, J.S. (1989): *Historical Geology – Evolution of the Earth and Life Through Time*, West Publishing Co., 577 p. Herak, M. (1990): *Geologija*, Školska knjiga, Zagreb, 450 p.			Stanley, S.M. (1989): *Earth and Life Through Time*, W. H. Freeman and Co., 689 p. Wicander, R. Monroe, J.S. (1989): *Historical Geology – Evolution of the Earth and Life Through Time*, West Publishing Co., 577 p. Herak, M. (1990): *Geologija*, Školska knjiga, Zagreb, 450 p.		

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Table 2B Description of the course that was amended and/or modified – Metamorphic Petrology

1. COURSE DECRIPTION – GENERAL INFORMATION		
	Before the modification	**After the modification**
1.1. Course teacher	Full Professor with tenure Dražen Balen, PhD	Full Professor with tenure Dražen Balen, PhD
1.2. Name of the course	Igneous and Metamorphic Petrology	**Metamorphic Petrology**
1.3. Associate teachers	Petra Schneider, Mag. Geol.	**Assistant according to the assignment schedule (exercises)**
1.4. Study programme (undergraduate, graduate, integrated)	Undergraduate	Undergraduate
1.5. Status of the course	Mandatory	Mandatory
1.6. Year of the study	2nd	2nd
1.7. ECTS credits	7	**4**
1.8. Type of instruction (number of hours L + E + S + e-learning)	45 + 45 + 0 + 0	**30 + 30** + 0 + 0
1.9. Expected enrolment in the course	36	36
1.10. Level of application of e-learning (level 1, 2, 3), percentage of online instruction (max. 20%)	Level 1, up to 5 %	Level 1, up to 5 %
2.1. Course objectives	Students achieve basic knowledge of igneous and metamorphic petrology needed for BSc level, i.e. classification and origin of common igneous and metamorphic rocks together with their environment and setting description. Basic knowledge includes elements of laboratory and field work.	**Students acquire basic knowledge of metamorphic rocks and fundamental petrogenetic processes.** **Students develop basic skills for the independent identification, determination and classification of metamorphic rocks using standard petrological techniques.**
2.2. Course enrolment requirements and/or entry competences required for the course	Passed: General Mineralogy, Physical Geology, System of Mineralogy	Passed: General Mineralogy, Physical Geology, System of Mineralogy
2.3. Learning outcomes at the level of the programme to which	GL_1) Basic knowledge and understanding of the natural sciences (Physics, Chemistry, Biology, Mathematics) underlying the study of Geology	**1) Recognise and apply basic and specific knowledge related to the fundamental laws of natural science in the interpretation of geological processes.**

the course contributes	GL_2) Knowledge and understanding of the essential features, processes, materials, history and the development of the Earth and life GL_3) Basic knowledge and understanding of the key aspects and concepts of geology GL_4) Knowledge of the common terminology and nomenclature and the use of bibliography in Geosciences GL_5) An awareness of the wider spectrum of geological disciplines GL_6) Awareness and understanding of the temporal and spatial dimensions in Earth processes GL_8) Awareness of major geological paradigms, the extent of geological time and Plate Tectonics GL_9) Knowledge and understanding of the complex nature of interactions within the geosphere GL_10) Appropriate knowledge of other disciplines relevant to geology GL_11) Ability to create simple geological models GL12) Some understanding of the complexity of geological problems and the feasibility of their solution GL_15) Knowledge of appropriate solution patterns for geological problems GL_16) Basic ability to describe a solution at an abstract level GL_22) Basic ability to apply appropriate technology and use relevant methods GL_23) Ability to use simple quantitative methods and to apply them to geological problems GL_24) Basic ability to independently analyse earth materials in the field and laboratory and to describe, process, document and report the results GL_26) Basic ability to combine theory and practice to complete geological tasks GL_27) Ability to undertake literature searches, and to use data bases and other sources of information GL_28) Ability to receive and respond to a variety of information sources (e.g. textual, numerical, verbal, graphical)	**2) Identify basic geological processes and geological materials, and connect them with the development of life on Earth and Earth itself.** **7) Use geological maps, domestic and foreign literature and databases, as well as other sources of information.** **9) Independently analyse geological samples in the laboratory, write and present results of research.** **12) Communicate and discuss ideas and solutions of geological problems with colleagues and experts.** **13) Design and generate simple geological models.**

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	GL_29) Ability to conduct appropriate experiments, to analyse and interpret data and draw conclusions GL_30) Basic awareness of relevant state-of-the-art technologies and their application	
2.4. Expected learning outcomes at the level of the course (3-10 learning outcomes)	1) Basic knowledge and understanding of the natural processes underlying the study of geology and igneous and metamorphic rocks genesis. 2) Knowledge and understanding of the properties of minerals in order to evaluate their role and genesis in igneous and metamorphic rocks. 3) Basic knowledge and understanding of genesis and alteration of minerals, and how they reflect environmental conditions. 4) Basic ability to apply appropriate technology and use relevant methods for research in petrology. 5) Ability to use simple quantitative methods and to apply them to geological problems. 6) Basic ability to combine theory and practice to complete geological tasks. 7) Basic awareness of relevant state-of-the-art technologies and their application. 8) Basic ability to prepare, process, interpret and present data, using appropriate qualitative and quantitative techniques and packages.	**1) Explains the structure of the Earth, the mechanisms of magma formation and evolution.** **2) Explains the dependence of mineralogy, texture and structure of metamorphic rocks on the conditions of their formation.** **3) Applies relevant classification principles and schemes for the identification of metamorphic rocks.** **4) Explains phase diagrams used in metamorphic petrology.** **5) Explains the relationship between of metamorphic rock associations and plate tectonic processes.** **6) Independently identifies mineral phases and their abundance in metamorphic rock samples.** **7) Writes reports on the observations made on metamorphic rock specimens.** **8) Reconstructs the history of metamorphic rock based on its mineralogical, structural and textural characteristics.** **9) Uses basic petrological literature with understanding.**
2.5. Course content (syllabus)	1) Rock forming minerals, structure, texture, mode of occurrence. Intrusive, vein and extrusive rocks. Pyroclastic rocks. 2) Earth mineral and chemical composition, magma, macro-, micro- and trace-elements, mineral mode and norms, variation diagrams, magmatic series. 3) Classification of igneous rocks. Volcanoes. 4) Magma origin and evolution. Magma emplacement and relative age. Magma crystallization and differentiation, crystallization and melting in binary and ternary systems. Influence of different geological factors on crystallization process. Partial melting. 5) Igneous rocks associations, plate tectonic in magmatic cycle.	**1) Basic concepts: metamorphism, limits and conditions in the crust, metamorphic grade. Metamorphism as part of the rock cycle.** 2) Classifications. Prograde and retrograde metamorphism. **Polyphase metamorphism.** 3) Protoliths. **Open and closed systems**. **Links between** mineral chemistry and chemical composition of protoliths. 4) Metamorphic minerals. Textures and structures of metamorphic rocks. **5) Occurrences and specific classifications of metamorphic rocks.** **6) P-T-X conditions and metamorphic mineral assemblages.** 7) Index minerals, metamorphic zones, isograde.

DESCRIPTION OF AMENDMENTS AND MODIFICATIONS TO UNDERGRADUATE, GRADUATE AND INTEGRATED UNDERGRADUATE AND GRADUATE STUDY PROGRAMMES

<table>
<tr><td></td><td colspan="2">6) Mantle, meteorites, petrology of terrestrial planets and satellites. Magmatism on the active and passive continental margins.
7) Igneous rocks of divergent plate margins, rift, oceanic crust, upper mantle. Volcanism inside oceanic plates, hot-spots, layered mafic intrusions, continental alkalic magmatism, anorthosites.
8) Igneous rocks of convergent margins, island arc, continental magmatic arc, ophiolite suite. Plate (continental-continental) collision, granite.
9) Metamorphism, limits, factors, grade.
10) Type and classification of metamorphism. Prograde and retrograde metamorphism.
11) Protoliths and chemical composition of metamorphic rocks. Rock forming minerals, textures and structures of metamorphic rocks. Classifications - scheme and recommendations.
12) Influence of pressure, temperature and fluids on the mineral assemblage. Metamorphic isograds, facies and facies series. Metamorphic belts.
13) Thermal, cataclastic, regional, sea floor, burial, impact, polyphase metamorphism.
14) Geotectonic settings of metamorphism.
15) Application of equilibrium concepts to metamorphic rocks, geotermobarometry basics, age of metamorphism, P-T-t reaction paths.</td><td colspan="2">8) Metamorphic facies and series of metamorphic facies.
9) Metamorphism at plate boundaries. Environments and conditions.
10) Contact, cataclastic and regional metamorphism.
11) Ocean floor metamorphism, burial metamorphism, shock metamorphism.
12) Equilibrium metamorphic assemblages, criteria and meaning.
13) Principles of P-T determination and mineral stability modelling. Geothermobarometry.
14) Principles of age dating in metamorphism.
15) Methods, approach, examples. P-T-t reaction paths.</td></tr>
<tr><td>2.6. Format of instruction:</td><td>☒ lectures
☐ seminars and workshops
☒ exercises
☐ online in entirety
☐ partial e-learning
☐ field work</td><td>☐ independent assignments
☐ multimedia and the internet
☐ laboratory
☐ work with mentor
☐ (other)</td><td>☒ lectures
☐ seminars and workshops
☒ exercises
☐ online in entirety
☐ partial e-learning
☐ field work</td><td>☐ independent assignments
☐ multimedia and the internet
☐ laboratory
☐ work with mentor
☐ (other)</td></tr>
<tr><td>2.7. Comments:</td><td colspan="2"></td><td colspan="2">The replacement of the existing course Igneous and Metamorphic Petrology with two courses Igneous Petrology and Metamorphic Petrology is requested, because of better organisation and sequence of course materials. Accordingly, the</td></tr>
</table>

DESCRIPTION OF AMENDMENTS AND MODIFICATIONS TO UNDERGRADUATE, GRADUATE AND INTEGRATED UNDERGRADUATE AND GRADUATE STUDY PROGRAMMES

<table>
<tr><td></td><td colspan="9"></td><td colspan="9">distribution of the ECTS points is requested: 4 ECTS for course Igneous Petrology and 4 ECTS for course Metamorphic Petrology.</td></tr>
<tr><td>2.8. Student obligations</td><td colspan="9">Fulfilment of obligations.</td><td colspan="9">Regular attendance of lectures and exercises. Midterm exams.</td></tr>
<tr><td rowspan="6">2.9. Monitoring student work</td><td>Class attendance</td><td>YES</td><td></td><td>Research</td><td></td><td>NO</td><td>Oral exam</td><td>YES</td><td></td><td>Class attendance</td><td>YES</td><td></td><td>Research</td><td></td><td>NO</td><td>Oral exam</td><td>YES</td><td></td></tr>
<tr><td>Experimental work</td><td></td><td>NO</td><td>Report</td><td></td><td>NO</td><td>(other)</td><td></td><td>NO</td><td>Experimental work</td><td></td><td>NO</td><td>Report</td><td></td><td>NO</td><td>(other)</td><td></td><td>NO</td></tr>
<tr><td>Essay</td><td></td><td>NO</td><td>Seminar paper</td><td></td><td>NO</td><td>(other)</td><td></td><td>NO</td><td>Essay</td><td></td><td>NO</td><td>Seminar paper</td><td></td><td>NO</td><td>(other)</td><td></td><td>NO</td></tr>
<tr><td>Preliminary exam</td><td>YES</td><td></td><td>Practical work</td><td>YES</td><td></td><td>(other)</td><td></td><td>NO</td><td>Preliminary exam</td><td>YES</td><td></td><td>Practical work</td><td>YES</td><td></td><td>(other)</td><td></td><td>NO</td></tr>
<tr><td>Project</td><td></td><td>NO</td><td>Written exam</td><td>YES</td><td></td><td>ECTS (total)</td><td>7</td><td></td><td>Project</td><td></td><td>NO</td><td>Written exam</td><td></td><td>NO</td><td>ECTS (total)</td><td>4</td><td></td></tr>
<tr><td colspan="10"></td><td colspan="9"></td></tr>
<tr><td rowspan="4">2.10. Required literature (available in the library and/or via other media)</td><td colspan="4">Title</td><td colspan="2">Number of copies in the library</td><td colspan="2">Availability via other media</td><td colspan="4">Title</td><td colspan="2">Number of copies in the library</td><td colspan="2">Availability via other media</td></tr>
<tr><td colspan="4">Best, M.G. (2003): Igneous and metamorphic petrology, Blackwell Publishing, 729 p.</td><td colspan="2">YES</td><td colspan="2">YES</td><td colspan="4">Vernon, R.H., Clarke, G.L. (2008): Principles of Metamorphic Petrology, Cambridge University Press, 446 p.</td><td colspan="2">YES</td><td colspan="2">YES</td></tr>
<tr><td colspan="4">Blatt, H., Tracy, R.J. (1996): Petrology. Igneous, Sedimentary and Metamorphic, W.H. Freeman and co., 529 p.</td><td colspan="2">YES</td><td colspan="2">NO</td><td colspan="4">Best, M.G. (2003): Igneous and Metamorphic Petrology, Blackwell Science Ltd., 729 p.</td><td colspan="2">YES</td><td colspan="2">YES</td></tr>
<tr><td colspan="4"></td><td colspan="2"></td><td colspan="2"></td><td colspan="4">Philpotts, A.R., Ague, J.J. (2009): Principles of Igneous and Metamorphic Petrology, Cambridge University Press, 667 p.</td><td colspan="2">YES</td><td colspan="2">YES</td></tr>
<tr><td>2.11. Optional literature</td><td colspan="9">Hyndman, D.W. (1985): Petrology of Igneous and Metamorphic Rocks, McGraw Hill Inc., N. Y., 786 p.
Thorpe, R., Brown, G. (1996): The field description of igneous rocks, John Wiley & Sons, 154 p.
Fry, N. (1996): The field description of metamorphic rocks, John Wiley & Sons, 111 p.</td><td colspan="9">Bucher, K., Frey, M. (2002): Petrogenesis of Metamorphic Rocks, Springer Verlag, 341 p.
Hyndman, D.W. (1985): Petrology of Igneous and Metamorphic Rocks, Mc Graw Hill Inc., N. Y., p.</td></tr>
</table>

DESCRIPTION OF AMENDMENTS AND MODIFICATIONS TO UNDERGRADUATE, GRADUATE AND INTEGRATED UNDERGRADUATE AND GRADUATE STUDY PROGRAMMES

Table 2B Description of the course that was amended and/or modified – Sedimentary Petrology

1. COURSE DECRIPTION – GENERAL INFORMATION		
	Before the modification	**After the modification**
1.1. Course teacher	Full Professor Marijan Kovačić, PhD, Assistant Professor Frane Marković, PhD	Full Professor Marijan Kovačić, PhD, Assistant Professor Frane Marković, PhD
1.2. Name of the course	Sedimentary Petrology	Sedimentary Petrology
1.3. Associate teachers		
1.4. Study programme (undergraduate, graduate, integrated)	Undergraduate	Undergraduate
1.5. Status of the course	Mandatory	Mandatory
1.6. Year of the study	2nd	2nd
1.7. ECTS credits	7	**5**
1.8. Type of instruction (number of hours L + E + S + e-learning)	45 + 45 + 0 + 0	45 + 45 + 0 + 0
1.9. Expected enrolment in the course	36	36
1.10. Level of application of e-learning (level 1, 2, 3), percentage of online instruction (max. 20%)	Level 1, up to 3 %	Level 1, up to 3 %
2.1. Course objectives	Acquaintance of students with the basic concepts, principles and applications of the petrology of sediments and sedimentary rocks.	Acquaintance of students with the basic concepts, principles and applications of the petrology of sediments and sedimentary rocks.
2.2. Course enrolment requirements and/or entry competences required for the course	Passed courses General Paleontology and System of Mineralogy and completed course in Mineral Optics.	Passed courses General Paleontology and System of Mineralogy and completed course in Mineral Optics.
2.3. Learning outcomes at the level of the programme to which the course contributes		**1) Recognise and apply basic and specific knowledge related to the fundamental laws of natural science in the interpretation of geological processes.**

DESCRIPTION OF AMENDMENTS AND MODIFICATIONS TO UNDERGRADUATE, GRADUATE AND INTEGRATED UNDERGRADUATE AND GRADUATE STUDY PROGRAMMES

		2) Identify basic geological processes and geological materials, and connect them with the development of life on Earth and Earth itself. **3) Identify simple geological problems and suggest possible solutions.**
2.4. Expected learning outcomes at the level of the course (3-10 learning outcomes)		**1) Recognize and describe basic groups of sediments and sedimentary rocks.** **2) Recognize the structures and textures of sedimentary rocks and explain how they are formed.** **3) Describe and partially apply the basic methods of work in sedimentology.** **4) Macroscopically or microscopically determine the modal composition of sediments and sedimentary rocks and classify the individual rock samples.** **5) Interpret fossil depositional environments on the basis of knowledge from sedimentary petrology and other geological disciplines.** **6) Apply analytical methods to investigate the basic mineralogical and chemical characteristics of sediments and sedimentary rocks.** **7) Apply sediments and sedimentary rocks in interpreting the development of life on Earth and paleoclimatic and paleogeographic changes.** 8) **Evaluate the economic importance of specific groups of sediments and sedimentary rocks.**
2.5. Course content (syllabus)	1) Basic concepts and definitions in the petrology of sediments. 2) Formation processes of sediments and sedimentary rocks. 3) Sedimentary textures. 4) Sedimentary structures. 5) Modal composition of clastites. 6) Coarse-grained and medium-grained clastites. 7) Pelitic sediments. 8) Depositional environments of clastites. 9) Limestones. 10) Dolomites. 11) Depositional environments of carbonates. 12) Evaporites.	1) Basic concepts and definitions in the petrology of sediments. 2) Formation processes of sediments and sedimentary rocks. 3) Sedimentary textures. 4) Sedimentary structures. 5) Modal composition of clastites. 6) Coarse-grained and medium-grained clastites. 7) Pelitic sediments. 8) Depositional environments of clastites. 9) Limestones. 10) Dolomites. 11) Depositional environments of carbonates. 12) Evaporites.

DESCRIPTION OF AMENDMENTS AND MODIFICATIONS TO UNDERGRADUATE, GRADUATE AND INTEGRATED UNDERGRADUATE AND GRADUATE STUDY PROGRAMMES

<table>
<tr><td></td><td>13) Cherrts.
14) Pyroclastites.
15) Coal and oil shales.</td><td>13) Cherts.
14) Pyroclastites.
15) Coal and oil shales.</td></tr>
<tr><td>2.6. Format of instruction:</td><td>☒ lectures
☐ seminars and workshops
☒ exercises
☐ online in entirety
☐ partial e-learning
☐ field work
☒ independent assignments
☐ multimedia and the internet
☐ laboratory
☐ work with mentor
☐ (other)</td><td>☒ lectures
☐ seminars and workshops
☒ exercises
☐ online in entirety
☐ partial e-learning
☐ field work
☒ independent assignments
☐ multimedia and the internet
☐ laboratory
☐ work with mentor
☐ (other)</td></tr>
<tr><td>2.7. Comments:</td><td></td><td>A decrease in ECTS points from 7 to 5 is requested.</td></tr>
<tr><td>2.8. Student obligations</td><td>Regular attendance of classes.</td><td>Regular attendance of classes.</td></tr>
<tr><td>2.9. Monitoring student work</td><td>
<table>
<tr><td>Class attendance</td><td>YES</td><td></td><td>Research</td><td></td><td>NO</td><td>Oral exam</td><td>YES</td><td></td></tr>
<tr><td>Experimental work</td><td></td><td>NO</td><td>Report</td><td></td><td>NO</td><td>(other)</td><td></td><td>NO</td></tr>
<tr><td>Essay</td><td></td><td>NO</td><td>Seminar paper</td><td></td><td>NO</td><td>(other)</td><td></td><td>NO</td></tr>
<tr><td>Preliminary exam</td><td>YES</td><td></td><td>Practical work</td><td>YES</td><td></td><td>(other)</td><td></td><td>NO</td></tr>
<tr><td>Project</td><td></td><td>NO</td><td>Written exam</td><td>YES</td><td></td><td>ECTS (total)</td><td>7</td><td></td></tr>
</table>
</td><td>
<table>
<tr><td>Class attendance</td><td>YES</td><td></td><td>Research</td><td></td><td>NO</td><td>Oral exam</td><td>YES</td><td></td></tr>
<tr><td>Experimental work</td><td>YES</td><td></td><td>Report</td><td></td><td>NO</td><td>(other)</td><td></td><td>NO</td></tr>
<tr><td>Essay</td><td></td><td>NO</td><td>Seminar paper</td><td></td><td>NO</td><td>(other)</td><td></td><td>NO</td></tr>
<tr><td>Preliminary exam</td><td>YES</td><td></td><td>Practical work</td><td>YES</td><td></td><td>(other)</td><td></td><td>NO</td></tr>
<tr><td>Project</td><td></td><td>NO</td><td>Written exam</td><td>YES</td><td></td><td>ECTS (total)</td><td>5</td><td></td></tr>
</table>
</td></tr>
<tr><td>2.10. Required literature (available in the library and/or via other media)</td><td>
<table>
<tr><th>Title</th><th>Number of copies in the library</th><th>Availability via other media</th></tr>
<tr><td>Tucker, M.E. (2008): Petrologija Sedimenata, AZP Grafis d.o.o., 262 p. (translation: G. Medunić)</td><td>YES</td><td>NO</td></tr>
<tr><td>Tišljar, J. (1994): Sedimentne stijene, Školska knjiga, 422 p.</td><td>YES</td><td>NO</td></tr>
</table>
</td><td>
<table>
<tr><th>Title</th><th>Number of copies in the library</th><th>Availability via other media</th></tr>
<tr><td>Tucker, M.E. (2008): Petrologija Sedimenata, AZP Grafis d.o.o., 262 p. (translation: G. Medunić)</td><td>YES</td><td>NO</td></tr>
<tr><td>Tišljar, J. (1994): Sedimentne stijene, Školska knjiga, 422 p.</td><td>YES</td><td>NO</td></tr>
</table>
</td></tr>
<tr><td>2.11. Optional literature</td><td></td><td>Tišljar, J. (2001): Sedimentologija karbonata i evaporita, Institut za geološka istraživanja, Zagreb, 375 p.
Tišljar, J. (2004): Sedimentologija klastičnih i silicijskih taložina, Institut za geološka istraživanja, Zagreb, 426 p.
Tucker, M.E., Jones, S.J. (2023): Sedimetary Petrology, Wiley & Sons Ltd, Croydon, 426 p.</td></tr>
</table>

DESCRIPTION OF AMENDMENTS AND MODIFICATIONS TO UNDERGRADUATE, GRADUATE AND INTEGRATED UNDERGRADUATE AND GRADUATE STUDY PROGRAMMES

Table 2B Description of the course that was amended and/or modified – Vertebrate Paleontology

1. COURSE DECRIPTION – GENERAL INFORMATION		
	Before the modification	**After the modification**
1.1. Course teacher	Associate Professor Aleksandar Mezga, PhD	Associate Professor Aleksandar Mezga, PhD
1.2. Name of the course	Vertebrate Paleontology	Vertebrate Paleontology
1.3. Associate teachers		
1.4. Study programme (undergraduate, graduate, integrated)	Undergraduate	Undergraduate
1.5. Status of the course	Mandatory	Mandatory
1.6. Year of the study	2nd	2nd
1.7. ECTS credits	3	**4**
1.8. Type of instruction (number of hours L + E + S + e-learning)	30 + 15 + 0 + 0	30 + 15 + 0 + 0
1.9. Expected enrolment in the course	35	35
1.10. Level of application of e-learning (level 1, 2, 3), percentage of online instruction (max. 20%)	Level 1, up to 3 %	Level 1, up to 3 %
2.1. Course objectives	Training of candidates for the scientific and practical work related to vertebrate paleontology	Training of candidates for the scientific and practical work related to vertebrate paleontology
2.2. Course enrolment requirements and/or entry competences required for the course	Passed courses: General Paleontology and Physical Geology	Passed courses: General Paleontology and Physical Geology
2.3. Learning outcomes at the level of the programme to which the course contributes	1) Knowledge and understanding of the essential features, processes, materials, history and the development of the Earth and life. 2) Knowledge of the common terminology and nomenclature and the use of bibliography in Geosciences. 3) An awareness of the wider spectrum of geological disciplines.	**1) Recognise and apply basic and specific knowledge related to the fundamental laws of natural science in the interpretation of geological processes.** **2) Identify basic geological processes and geological materials, and connect them with the development of life on Earth and Earth itself.**

	4) Awareness and understanding of the temporal and spatial dimensions in Earth processes. 5) Understanding the need of a rational use of earth resources. 6) Basic ability in the formalisation and specification of problems whose solution involves the use of geological methods. 7) Basic ability to describe a solution at an abstract level. 8) Knowledge of the range of applications of Geology. 9) Ability to integrate field and laboratory evidence with theory following the sequence from observation to recognition, synthesis and modelling. 10) Appreciation of issues concerning sample selection, accuracy, precision and uncertainty during collection, recording and analysis of data in the field and laboratory. 11) Ability to formulate and test hypotheses. 12) Ability to use simple quantitative methods and to apply them to geological problems. 13) Basic ability to independently analyse earth materials in the field and laboratory and to describe, process, document and report the results. 14) Ability to undertake field and lab investigation in a responsible and safe manner, paying due attention to risk assessment, rights of access, relevant health and safety regulations, and sensitivity to the impact of investigation on the environment and stakeholders. 15) Basic ability to combine theory and practice to complete geological tasks. 16) Ability to undertake literature searches, and to use data bases and other sources of information. 17) Ability to receive and respond to a variety of information sources (e.g. textual, numerical, verbal, graphical). 18) Ability to work effectively as an individual and as a member of a team. 19) Recognition of the need for, and engagement in self-managed and life-long learning. 20) Ability to organise their own work independently. 21) Basic ability to communicate effectively in written and verbal form with colleagues, other professionals, customers and the	**3) Select and use suitable geological methods and specific technologies in solving geological problems.** **4) Use geological maps, domestic and foreign literature and databases, as well as other sources of information.** **5) Identify problems related to sampling and data processing in field and laboratory research.** **6) Communicate and discuss ideas and solutions of geological problems with colleagues and experts.**

DESCRIPTION OF AMENDMENTS AND MODIFICATIONS TO UNDERGRADUATE, GRADUATE AND INTEGRATED UNDERGRADUATE AND GRADUATE STUDY PROGRAMMES

	general public about substantive issues and problems related to their chosen specialisation. 22) Basic ability to prepare, process, interpret and present data, using appropriate qualitative and quantitative techniques and packages.	
2.4. Expected learning outcomes at the level of the course (3-10 learning outcomes)	After completing the degree program, students will know the use of a specialized theoretical and practical knowledge that forms the basis for originality in developing and / or application of science ideas. In doing so, develop the new understandings in response to new knowledge and techniques. Show independence in the direction of learning and a high level of understanding of the learning process.	**1) Recognize and interpret vertebrate fossils.** **2) Select and use suitable methods for taxonomic interpretations of fossil vertebrates.** **3) Identify the basic evolution lines of fossil vertebrates.** **4) Apply acquired knowledge in the development and application of natural science ideas.**
2.5. Course content (syllabus)	Fossil skeletons and fossilization of vertebrates in marine, freshwater and continental sedimentary areas. The principles of classical, evolutionary and phylogenetic systematics (kladograms). Characteristics of osteological materials and odontological parts (skeleton head and limb bones, teeth and other inorganic "formation." Taxonomy of the most common vertebrate fossils preserved (from agnatha to gnathostomata, fish, amphibians, reptiles, birds and mammals, with particular emphasis on the development of primates and the origin man). The main examples of evolutionary sequences, distribution and extinction. the role of vertebrates in biostratigraphy. Palaeobiogeography	**1) Fossilization and preservation of fossil vertebrates** **2) Vertebrate anatomy and osteology** **3) Classification systems in vertebrate paleontology** **4) Agnatha, Placodermi, Acanthodii and Chondrichthyes** **5) Osteichthyes and Tetrapodomorpha** **6) Tetrapoda and Amphibia** **7) Synapsida and Reptilia** **8) Lepidosauromorpha** **9) Dinosauria** **10) Aves** **11) Mammalia (Allotheria, Monotremata and Metatheria)** **12) Mammalia (Eutheria)** **13) Primates**
2.6. Format of instruction:	☒ lectures ☒ seminars and workshops ☒ exercises ☐ online in entirety ☐ partial e-learning ☐ field work ☒ independent assignments ☒ multimedia and the internet ☐ laboratory ☐ work with mentor ☐ (other)	☒ lectures ☐ **seminars and workshops** ☒ exercises ☐ online in entirety ☐ partial e-learning ☐ field work ☐ **independent assignments** ☒ multimedia and the internet ☐ laboratory ☐ work with mentor ☐ (other)
2.7. Comments:		**An increase in ECTS points from the previous 3 to the proposed 4 is requested, because the previous number of ECTS points did not correspond to the point value of the course.**
2.8. Student obligations	Regular attendance at exercises, taking tests, work assignments, seminar essays.	**Regular attendance at course and exercises, taking tests.**

DESCRIPTION OF AMENDMENTS AND MODIFICATIONS TO UNDERGRADUATE, GRADUATE AND INTEGRATED UNDERGRADUATE AND GRADUATE STUDY PROGRAMMES

2.9. Monitoring student work	Class attendance	YES		Research		NO	Oral exam		NO	Class attendance	YES		Research		NO	Oral exam	**YES**	
	Experimental work		NO	Report		NO	(other)		NO	Experimental work		NO	Report		NO	(other)		NO
	Essay		NO	Seminar paper	YES		(other)		NO	Essay		NO	Seminar paper		**NO**	(other)		NO
	Preliminary exam	YES		Practical work	YES		(other)		NO	Preliminary exam	YES		Practical work	YES		(other)		NO
	Project		NO	Written exam	YES		ECTS (total)	3		Project		NO	Written exam	YES		ECTS (total)	**4**	

	Title	**Number of copies in the library**	**Availability via other media**	**Title**	**Number of copies in the library**	**Availability via other media**
2.10. Required literature (available in the library and/or via other media)	Benton, M.J. (2015): *Vertebrate Paleontology,* Chapman & Hall. London	YES	NO	Benton, M.J. (2015): *Vertebrate Paleontology,* Chapman & Hall. London	YES	NO
	Chernicoff, S., Fox, H.A., Tanner, L.H. (2002): *Earth: Geologic principles and history,* Houghton Mifflin Comp. Boston, New York	YES	NO	Chernicoff, S., Fox, H.A., Tanner, L.H. (2002): *Earth: Geologic principles and history,* Houghton Mifflin Comp. Boston, New York	YES	NO
	Carroll, R.L. (1998): *Vertebrate Paleontology and Evolution,* W.H. Freeman & Co.,New York	YES	NO	Carroll, R.L. (1998): *Vertebrate Paleontology and Evolution,* W.H. Freeman & Co.,New York	YES	NO
	Palmer, D. (2011): *Earth in 100 groundbreaking discoveries,* Quercus Pub. Pic.London	YES	NO	Palmer, D. (2011): *Earth in 100 groundbreaking discoveries,* Quercus Pub. Pic.London	YES	NO
2.11. Optional literature	Scientific articles.			Scientific articles.		

DESCRIPTION OF AMENDMENTS AND MODIFICATIONS TO UNDERGRADUATE, GRADUATE AND INTEGRATED UNDERGRADUATE AND GRADUATE STUDY PROGRAMMES

Table 2B Description of the course that was amended and/or modified – Geophysics

1. COURSE DECRIPTION – GENERAL INFORMATION		
	Before the modification	**After the modification**
1.1. Course teacher	Associate Professor Snježana Markušić, PhD	Associate Professor Snježana Markušić, PhD
1.2. Name of the course	Geophysics	Geophysics
1.3. Associate teachers		
1.4. Study programme (undergraduate, graduate, integrated)	Undergraduate	Undergraduate
1.5. Status of the course	Mandatory	Mandatory
1.6. Year of the study	2nd	2nd
1.7. ECTS credits	5	5
1.8. Type of instruction (number of hours L + E + S + e-learning)	30 + 15 + 0 + 0	30 + 15 + 0 + **10**
1.9. Expected enrolment in the course	30 – 50	30 – 50
1.10. Level of application of e-learning (level 1, 2, 3), percentage of online instruction (max. 20%)	Level 1, up to 5 %	Level 1, up to 5 %
2.1. Course objectives		**To introduce students to the basics of geophysics. Explain the origin of the planet Earth, its shape, and the forces that rule on the surface. Explain the processes that take place in the interior of the Earth and connect them with phenomena on the surface and in the atmosphere. To train students to acquire basic operational knowledge of data processing methods, as well as to acquire skills in solving basic numerical problems in geophysics.**
2.2. Course enrolment requirements and/or entry competences required for the course		**Acquired basics of physics and mathematics (extent of knowledge from the courses Physics, Mathematics I and Mathematics II in the 1st year of study).**

DESCRIPTION OF AMENDMENTS AND MODIFICATIONS TO UNDERGRADUATE, GRADUATE AND INTEGRATED UNDERGRADUATE AND GRADUATE STUDY PROGRAMMES

2.3. Learning outcomes at the level of the programme to which the course contributes	1) Basic knowledge and understanding of the natural sciences (Physics, Chemistry, Biology, Mathematics) underlying the study of Geology 2) Knowledge and understanding of the essential features, processes, materials, history and the development of the Earth and life 3) Basic knowledge and understanding of the key aspects and concepts of geology 4) Knowledge of the common terminology and nomenclature and the use of bibliography in Geosciences 5) An awareness of the wider spectrum of geological disciplines 6) Awareness and understanding of the temporal and spatial dimensions in Earth processes 7) Awareness of the applications and responsibilities of Geology and its role in society including its environmental aspects 8) Awareness of major geological paradigms, the extent of geological time and Plate Tectonics 9) Knowledge and understanding of the complex nature of interactions within the geosphere 10) Appropriate knowledge of other disciplines relevant to geology 11) Ability to create simple geological models 12) Some understanding of the complexity of geological problems and the feasibility of their solution 13) Understanding the need of a rational use of earth resources 14) Basic ability in the formalisation and specification of problems whose solution involves the use of geological methods 15) Knowledge of appropriate solution patterns for geological problems 16) Basic ability to describe a solution at an abstract level 17) Knowledge of the range of applications of Geology	**1) Basic knowledge and understanding of natural sciences essential for the study of geology;** **2) Knowledge and understanding of the basic features, processes, materials, history and development of the Earth;** **3) Knowledge of basic terminology, nomenclature and bibliography in geosciences;** **4) Comprehension and understanding of the temporal and spatial dimensions of processes on Earth;** **5) Knowledge and understanding of the complexity of interactions in the geosphere;** **6) Ability to search literature and use databases in performing geological tasks;** **7) Basic ability to solve numerical problems using computer and non-computer techniques.**
2.4. Expected learning outcomes at the	1) Basic knowledge and understanding of the basics of geophysics essential for the study of geology;	**1) Understand the basics of geophysics essential for the study of geology;**

DESCRIPTION OF AMENDMENTS AND MODIFICATIONS TO UNDERGRADUATE, GRADUATE AND INTEGRATED UNDERGRADUATE AND GRADUATE STUDY PROGRAMMES

<table>
<tr><td>level of the course (3-10 learning outcomes)</td><td colspan="2">2) Knowledge and understanding of the complexity of the interaction between solid Earth physics and geology;
3) Ability to search literature and other sources of information;
4) Basic knowledge of the application of geophysical methods in geology;
5) Ability to work effectively independently and in a team.</td><td colspan="2">2) Identify the basic physical laws important for the Earth and the physical phenomena in, on and around the Earth;
3) Understand the complexity of the interaction between solid Earth physics and geology;
4) Apply of the basics of geophysics and geophysical calculations during geological research and analysis;
5) Demonstrate the use of literature and other sources of information;
6) Identify a numerical expression that describes a geophysical phenomenon.</td></tr>
<tr><td>2.5. Course content (syllabus)</td><td colspan="2"></td><td colspan="2">1) Planet Earth
2) Coordinates on the Earth's surface
3) Shape of the Earth
4) Force of attraction
5) Centrifugal force
6) Gravity and surface level
7) Anomaly of gravity field
8) Isostasy
9) Seismicity and earthquake sources
10) Macroseismic method of the earthquake investigation
11) Microseismic method of the earthquake investigation
12) Seismic waves – types, propagation, wave path parameter
13) Structure of the Earth's interior
14) Earth's magnetism
15) Earth's internal heat</td></tr>
<tr><td>2.6. Format of instruction:</td><td>☒ lectures
☐ seminars and workshops
☒ exercises
☐ online in entirety
☐ partial e-learning
☐ field work</td><td>☒ independent assignments
☐ multimedia and the internet
☐ laboratory
☐ work with mentor
☐ (other)</td><td>☒ lectures
☐ seminars and workshops
☒ exercises
☐ online in entirety
☒ partial e-learning
☐ field work</td><td>☒ independent assignments
☐ multimedia and the internet
☐ laboratory
☐ work with mentor
☐ (other)</td></tr>
<tr><td>2.7. Comments:</td><td colspan="2"></td><td colspan="2"></td></tr>
<tr><td>2.8. Student obligations</td><td colspan="2"></td><td colspan="2">During the semester, it is mandatory to cover one seminar topic from the course area and to participate in colloquiums. At each of the two colloquiums, it is necessary to collect at least 20 % of points.</td></tr>
</table>

DESCRIPTION OF AMENDMENTS AND MODIFICATIONS TO UNDERGRADUATE, GRADUATE AND INTEGRATED UNDERGRADUATE AND GRADUATE STUDY PROGRAMMES

2.9. Monitoring student work	Class attendance	YES		Research		NO	Oral exam	YES		Class attendance	YES		Research		NO	Oral exam	YES	
	Experimental work		NO	Report		NO	(other)		NO	Experimental work		NO	Report		NO	(other)		NO
	Essay		NO	Seminar paper	YES		(other)		NO	Essay		NO	Seminar paper	YES		(other)		NO
	Preliminary exam	YES		Practical work	YES		(other)		NO	Preliminary exam	YES	NO	Practical work	YES		(other)		NO
	Project		NO	Written exam	YES		ECTS (total)	5		Project		NO	Written exam	YES		ECTS (total)	5	

	Title	**Number of copies in the library**	**Availability via other media**	**Title**	**Number of copies in the library**	**Availability via other media**
2.10. Required literature (available in the library and/or via other media)	Bullen, K.E., Bolt, B.A. (1985): *Introduction to the theory of geophysics*, Cambridge	YES	NO	**Lowrie, W. (2011): *Fundamentals of Geophysics*, Cambridge University Press**	**YES**	**YES**
	Kasumović, M. (1971): *Opća i primijenjena geofizika s osnovama sferne astronomije (I dio Opća geofizika)*, Sveučilište u Zagrebu, Zagreb	YES	NO	Lay, T., Wallace, T.C. (1995): *Modern global seismology*, Academic Press, Toronto	YES	YES
	Lay, T., Wallace, T.C. (1995): *Modern global seismology*, Academic Press, Toronto	YES	YES	**Turcotte, D.L., Schubert, G. (2002): *Geodynamics*, Cambridge University Press**	**YES**	**NO**
2.11. Optional literature						

DESCRIPTION OF AMENDMENTS AND MODIFICATIONS TO UNDERGRADUATE, GRADUATE AND INTEGRATED UNDERGRADUATE AND GRADUATE STUDY PROGRAMMES

Table 2B Description of the course that was amended and/or modified – Seminar

1. COURSE DECRIPTION – GENERAL INFORMATION		
	Before the modification	**After the modification**
1.1. Course teacher		
1.2. Name of the course	Seminar II	**Seminar**
1.3. Associate teachers		
1.4. Study programme (undergraduate, graduate, integrated)	Undergraduate	Undergraduate
1.5. Status of the course	Mandatory	**Elective**
1.6. Year of the study	2nd	2nd
1.7. ECTS credits	2	**3**
1.8. Type of instruction (number of hours L + E + S + e-learning)	0 + 0 + 15 + 0	0 + 0 + 15 + 0
1.9. Expected enrolment in the course		**30 – 35**
1.10. Level of application of e-learning (level 1, 2, 3), percentage of online instruction (max. 20%)		**Level 1, 5 %**
2.1. Course objectives	To develop the student's ability to independently use scientific and professional literature.	**The development of the ability to independently use scientific and professional literature.**
2.2. Course enrolment requirements and/or entry competences required for the course		
2.3. Learning outcomes at the level of the programme to which the course contributes		**1) Recognise and apply basic and specific knowledge related to the fundamental laws of natural science in the interpretation of geological processes.** **2) Identify basic geological processes and geological materials, and connect them with the development of life on Earth and Earth itself.**

DESCRIPTION OF AMENDMENTS AND MODIFICATIONS TO UNDERGRADUATE, GRADUATE AND INTEGRATED UNDERGRADUATE AND GRADUATE STUDY PROGRAMMES

<table>
<tr><td></td><td></td><td>3) Apply information technologies (IT) when processing and presenting data.
4) Use geological maps, domestic and foreign literature and databases, as well as other sources of information.</td></tr>
<tr><td>2.4. Expected learning outcomes at the level of the course (3-10 learning outcomes)</td><td></td><td>1) Use scientific literature and databases as sources of information.
2) Communicate and argue ideas and solutions related to the topic of the work.
3) Apply IT technologies when writing and processing work and presenting data.</td></tr>
<tr><td>2.5. Course content (syllabus)</td><td>During the semester, the student refers to one published paper from a reputable journal, about which he prepares a written composition and presents it orally in front of students and teachers.</td><td>During the semester, the student refers to one published paper from a reputable journal, about which he prepares a written composition and presents it orally in front of students and teachers.</td></tr>
<tr><td>2.6. Format of instruction:</td><td>☐ lectures
☐ seminars and workshops
☐ exercises
☐ online in entirety
☐ partial e-learning
☐ field work
☒ independent assignments
☐ multimedia and the internet
☐ laboratory
☒ work with mentor
☐ (other)</td><td>☐ lectures
☐ seminars and workshops
☐ exercises
☐ online in entirety
☐ partial e-learning
☐ field work
☒ independent assignments
☐ multimedia and the internet
☐ laboratory
☒ work with mentor
☐ (other)</td></tr>
<tr><td>2.7. Comments:</td><td></td><td>An increase in the number of ECTS credits from 2 to 3 is requested in order to harmonize with the content of the course.</td></tr>
<tr><td>2.8. Student obligations</td><td>Presentation and defense in front of students and teachers.</td><td>Presentation and defense in front of students and teachers.</td></tr>
<tr><td>2.9. Monitoring student work</td><td>
<table>
<tr><td>Class attendance</td><td></td><td>NO</td><td>Research</td><td>YES</td><td></td><td>Oral exam</td><td></td><td>NO</td></tr>
<tr><td>Experimental work</td><td></td><td>NO</td><td>Report</td><td></td><td>NO</td><td>(other)</td><td></td><td>NO</td></tr>
<tr><td>Essay</td><td></td><td>NO</td><td>Seminar paper</td><td>YES</td><td></td><td>(other)</td><td></td><td>NO</td></tr>
<tr><td>Preliminary exam</td><td></td><td>NO</td><td>Practical work</td><td></td><td>NO</td><td>(other)</td><td></td><td>NO</td></tr>
<tr><td>Project</td><td></td><td>NO</td><td>Written exam</td><td></td><td>NO</td><td>ECTS (total)</td><td>2</td><td></td></tr>
</table>
</td><td>
<table>
<tr><td>Class attendance</td><td></td><td>NO</td><td>Research</td><td>YES</td><td></td><td>Oral exam</td><td></td><td>NO</td></tr>
<tr><td>Experimental work</td><td></td><td>NO</td><td>Report</td><td></td><td>NO</td><td>(other)</td><td></td><td>NO</td></tr>
<tr><td>Essay</td><td></td><td>NO</td><td>Seminar paper</td><td>YES</td><td></td><td>(other)</td><td></td><td>NO</td></tr>
<tr><td>Preliminary exam</td><td></td><td>NO</td><td>Practical work</td><td></td><td>NO</td><td>(other)</td><td></td><td>NO</td></tr>
<tr><td>Project</td><td></td><td>NO</td><td>Written exam</td><td></td><td>NO</td><td>ECTS (total)</td><td>3</td><td></td></tr>
</table>
</td></tr>
<tr><td>2.10. Required literature (available in the library and/or via other media)</td><td>
<table>
<tr><th>Title</th><th>Number of copies in the library</th><th>Availability via other media</th></tr>
<tr><td></td><td></td><td></td></tr>
</table>
</td><td>
<table>
<tr><th>Title</th><th>Number of copies in the library</th><th>Availability via other media</th></tr>
<tr><td>Scientific articles</td><td>YES</td><td>YES</td></tr>
</table>
</td></tr>
</table>

DESCRIPTION OF AMENDMENTS AND MODIFICATIONS TO UNDERGRADUATE, GRADUATE AND INTEGRATED UNDERGRADUATE AND GRADUATE STUDY PROGRAMMES

2.11. Optional literature						

DESCRIPTION OF AMENDMENTS AND MODIFICATIONS TO UNDERGRADUATE, GRADUATE AND INTEGRATED UNDERGRADUATE AND GRADUATE STUDY PROGRAMMES

Table 2A Description of the new course – Basics of Geomorphology

1. COURSE DECRIPTION – GENERAL INFORMATION			
1.1. Course teacher	Full Professor Neven Bočić, PhD	1.6. Year of the study	2nd and 3rd
1.2. Name of the course	Basic of Geomorphology	1.7. ECTS credits	5
1.3. Associate teachers		1.8. Type of instruction (number of hours L + S + E + e-learning)	30 + 15 + 0 + 0
1.4. Study programme (undergraduate, graduate, integrated)	Undergraduate	1.9. Expected enrolment in the course	
1.5. Status of the course	Elective	1.10. Level of application of e-learning (level 1, 2, 3), percentage of online instruction (max. 20%)	
2. COURSE DESCRIPTION			
2.1. Course objectives	The main goals of this course are for students to acquire basic knowledge and basic skills related to geomorphology. The specific goals are: - to become familiar with the sources and methods of geomorphological research - understand the Earth's surface system including features, conditions, processes and changes - to understand the impact of endogenous processes on relief formation - to understand the impact of exogenous processes on relief formation - become familiar with the method of making and content of geomorphological maps		
2.2. Enrolment requirements and/or entry competences required for the course	Completed course Physical Geology		
2.3. Learning outcomes at the level of the programme to which the course contributes	1) Recognise and apply basic and specific knowledge related to the fundamental laws of natural science in the interpretation of geological processes. 2) Identify basic geological processes and geological materials, and connect them with the development of life on Earth and Earth itself. 3) Identify simple geological problems and suggest possible solutions. 4) Apply information technologies (IT) when processing and presenting data. 5) Perform relevant experiments and analyses independently or in a group and present data using suitable qualitative and quantitative methods. 6) Use geological maps, domestic and foreign literature and databases, as well as other sources of information. 7) Communicate and discuss ideas and solutions of geological problems with colleagues and experts. 8) Recognise the role of geology in knowledge development, valuation of goods, spatial arrangement, improvement of life quality and environmental preservation. 9) Plan further professional development on the basis of acquired geological knowledge and developed specific skills.		
2.4. Expected learning outcomes	1) Explain the goal, tasks and division of geomorphology		

DESCRIPTION OF AMENDMENTS AND MODIFICATIONS TO UNDERGRADUATE, GRADUATE AND INTEGRATED UNDERGRADUATE AND GRADUATE STUDY PROGRAMMES

<table>
<tr><td>at the level of the course
(3-10 learning outcomes)</td><td colspan="9">2) Apply basic relief analysis methods
3) Use the main data sources in geomorphology
4) Identify and explain the factors of relief formation
5) Explain the conditions and processes of the formation of endogenous relief types
6) Explain the conditions and processes of the formation of exogenous relief types
7) Recognize on the map and name the basic relief forms for each morphogenic type
8) Interpret the content of the geomorphological map of a certain area</td></tr>
<tr><td>2.5. Course content (syllabus)</td><td colspan="9">1) Introduction to geomorphology
2) Factors shaping the relief
3) Methodological approaches
4) Data sources
5) Structural geomorphology 1
6) Structural geomorphology 2
7) Exogenous geomorphology
8) Hillslope relief
9) Fluviodenudation and fluvial relief
10) Karst and fluviokarst relief
11) Speleological features in karst
12) Glacial and marine relief
13) Aeolian, sufosian, biogenic and anthropogenic relief
14) Geomorphological maps and mapping
15) Applied geomorphology</td></tr>
<tr><td>2.6. Format of instruction:</td><td colspan="4">☒ lectures
☐ seminars and workshops
☒ exercises
☐ online in entirety
☐ partial e-learning
☐ field work</td><td colspan="3">☐ independent assignments
☐ multimedia and the internet
☐ laboratory
☐ work with mentor
☐ (other)</td><td colspan="2">2.7. Comments:</td></tr>
<tr><td>2.8. Student obligations</td><td colspan="9">Attending classes.</td></tr>
<tr><td rowspan="5">2.9. Monitoring student work</td><td>Class attendance</td><td>YES</td><td></td><td>Research</td><td></td><td>NO</td><td>Oral exam</td><td>YES</td><td></td></tr>
<tr><td>Experimental work</td><td></td><td>NO</td><td>Report</td><td></td><td>NO</td><td>(other)</td><td></td><td>NO</td></tr>
<tr><td>Essay</td><td></td><td>NO</td><td>Seminar paper</td><td></td><td>NO</td><td>(other)</td><td></td><td>NO</td></tr>
<tr><td>Preliminary exam</td><td></td><td>NO</td><td>Practical work</td><td>YES</td><td></td><td>(other)</td><td></td><td>NO</td></tr>
<tr><td>Project</td><td></td><td>NO</td><td>Written exam</td><td>YES</td><td></td><td>ECTS (total)</td><td>5</td><td></td></tr>
</table>

DESCRIPTION OF AMENDMENTS AND MODIFICATIONS TO UNDERGRADUATE, GRADUATE AND INTEGRATED UNDERGRADUATE AND GRADUATE STUDY PROGRAMMES

	Title	Number of copies in the library	Availability via other media
2.10. Required literature (available in the library and/or via other media)	Bierman, P.R., Montgomery, D.R. (2020): *Key Concepts in Geomorphology Second Edition*, W.H. Freeman	YES	NO
2.11. Optional literature (name the title)	Summerfield, M.A. (2013): *Global Geomorphology: An introduction to the study of landforms*, Routledge Journals: *Geomorphology, Zeitschrift für Geomorphologie, Earth Surface Processes and Landforms*		

DESCRIPTION OF AMENDMENTS AND MODIFICATIONS TO UNDERGRADUATE, GRADUATE AND INTEGRATED UNDERGRADUATE AND GRADUATE STUDY PROGRAMMES

Table 2B Description of the course that was amended and/or modified – Field course in Geology II

1. COURSE DECRIPTION – GENERAL INFORMATION		
	Before the modification	**After the modification**
1.1. Course teacher	Full Professor Dražen Balen, PhD, Full Professor Damir Bucković, PhD, Full Professor Marijan Kovačić, PhD, Senior Lecturer Dražen Kurtanjek, MSc	Full Professor Dražen Balen, PhD, Full Professor Damir Bucković, PhD, Full Professor Marijan Kovačić, PhD, Senior Lecturer Dražen Kurtanjek, MSc
1.2. Name of the course	Field Course in Geology II	Field Course in Geology II
1.3. Associate teachers		
1.4. Study programme (undergraduate, graduate, integrated)	Undergraduate	Undergraduate
1.5. Status of the course	Mandatory	Mandatory
1.6. Year of the study	2nd	2nd
1.7. ECTS credits	7	**5**
1.8. Type of instruction (number of hours L + E + S + e-learning)	0 + 90 + 0 + 0	0 + 90 + 0 + 0
1.9. Expected enrolment in the course	25	25
1.10. Level of application of e-learning (level 1, 2, 3), percentage of online instruction (max. 20%)		**Level 1, up to 3 %**
2.1. Course objectives	Acquiring knowledge about the characteristics and types of igneous, metamorphic and sedimentary rocks and about approaches to interpreting the process of their formation. Gaining knowledge about the structure and environments of the formation of the chronostratigraphic units of the Dinarides from the Upper Palaeozoic, Mesozoic and Cainozoic. Students learn how to observe, study and record features in rocks, and how to recognize individual chronostratigraphic units of the Dinarides. The observed phenomena are understood as part of the wider geological structure and evolution of the wider area. Fieldwork is an integral part of the courses Historical Geology I, Igneous and Metamorphic Petrology, Sedimentary Petrology and Historical	Acquiring knowledge about the characteristics and types of igneous, metamorphic and sedimentary rocks and about approaches to interpreting the process of their formation. Gaining knowledge about the structure and environments of the formation of the chronostratigraphic units of the Dinarides from the Upper Palaeozoic, Mesozoic and Cainozoic. Students learn how to observe, study and record features in rocks, and how to recognize individual chronostratigraphic units of the Dinarides. The observed phenomena are understood as part of the wider geological structure and evolution of the wider area. Fieldwork is an integral part of the courses Historical Geology I, Igneous Petrology, Metamorphic Petrology,

DESCRIPTION OF AMENDMENTS AND MODIFICATIONS TO UNDERGRADUATE, GRADUATE AND INTEGRATED UNDERGRADUATE AND GRADUATE STUDY PROGRAMMES

	Geology II. The goal includes teaching about the basic field tools of geologists.	Sedimentary Petrology and Historical Geology II. The goal includes teaching about the basic field tools of geologists.
2.2. Course enrolment requirements and/or entry competences required for the course	Conditions for enrolling the course: Enrolled: Historical Geology II Enrolled: Igneous and Metamorphic Petrology Enrolled: Sedimentary Petrology Completed: Historical Geology I Completed: Mineral Optics Conditions for taking the course: Passed: Physical Geology Passed: General Paleontology	Conditions for enrolling the course: Enrolled: Historical Geology II **Enrolled: Igneous Petrology** **Enrolled: Metamorphic Petrology** Enrolled: Sedimentary Petrology Completed: Historical Geology I Completed: Mineral Optics Conditions for taking the course: Passed: Physical Geology Passed: General Paleontology
2.3. Learning outcomes at the level of the programme to which the course contributes	Governing the basic principles in field work related to all types of rocks, as well as familiarization with litho- and biofacies of large geotectonic units	**1) Recognise and apply basic and specific knowledge related to the fundamental laws of natural science in the interpretation of geological processes.** **2) Identify basic geological processes and geological materials, and connect them with the development of life on Earth and Earth itself.** **3) Apply information technologies (IT) when processing and presenting data.** **4) Perform relevant experiments and analyses independently or in a group and present data using suitable qualitative and quantitative methods.** **5) Use geological maps, domestic and foreign literature and databases, as well as other sources of information.** **6) Conduct field research independently or in a group and collect, describe and classify geological samples.** **7) Organise field and laboratory data and compare them with acquired professional knowledge.**
2.4. Expected learning outcomes at the level of the course (3-10 learning outcomes)	1) Orientation in space 2) Reading topographic maps in the field 3) Independent keeping of a field diary 4) Team work 5) Field determination of rocks	**1) Independently or in a group, orient yourself in the field with the help of a topographic and geological map and keep a field diary.** **2) Recognize, describe and explain processes in different geological environments based on mineral composition, structures and textures.** **3) Apply appropriate methods of field work in the classification, analysis and interpretation of rocks.**

DESCRIPTION OF AMENDMENTS AND MODIFICATIONS TO UNDERGRADUATE, GRADUATE AND INTEGRATED UNDERGRADUATE AND GRADUATE STUDY PROGRAMMES

<table>
<tr><td></td><td></td><td colspan="2">4) Independently or in a group, prepare, process, present and interpret data from the available literature and from rock outcrops and conceive simple geological models of origin.
5) Apply acquired knowledge in the interpretation of the environment.
6) Sketch and explain the geological relationships of the rocks recognized in the field.
7) Propose a simple model of the evolution.</td></tr>
<tr><td>2.5. Course content (syllabus)</td><td colspan="2">1) Getting to know the terrain
2) Independent work in the field and in the base
3) Getting to know the mineral composition
4) Getting to know the structures and textures of rocks
5) Recording of geological columns and profiles</td><td colspan="2">1) Acquaintance with litho- and biofacies of the Carboniferous and Permian Karst Dinarides;
2) Acquaintance with the litho- and biofacies of the Lower, Middle and Upper Triassic of the Karst Dinarides;
3) Acquaintance with the litho- and biofacies of the Lower and Upper Jurassic of the Karst Dinarides;
4) Acquaintance with the litho- and biofacies of the Lower and Upper Cretaceous of the Karst Dinarides;
5) Acquaintance with the Eocene litho- and biofacies of the Karst Dinarides;
6) Acquaintance with the Oligocene lithofacies of the Karst Dinarides;
7) Getting to know the basic geological structure and typical localities of the Slavonian Mountains (Psunj, Papuk, Krndija, Dilj, Požeška Gora)
8) Getting to know the basic geological structure and typical localities of Hrvatsko Zagorje;
9) Acquaintance with the basic geological structure and typical localities of Moslavačka Gora Mt.</td></tr>
<tr><td>2.6. Format of instruction:</td><td>☐ lectures
☐ seminars and workshops
☐ exercises
☐ online in entirety
☐ partial e-learning
☒ field work</td><td>☐ independent assignments
☐ multimedia and the internet
☐ laboratory
☐ work with mentor
☐ (other)</td><td>☐ lectures
☐ seminars and workshops
☐ exercises
☐ online in entirety
☐ partial e-learning
☒ field work</td><td>☐ independent assignments
☐ multimedia and the internet
☐ laboratory
☐ work with mentor
☐ (other)</td></tr>
<tr><td>2.7. Comments:</td><td colspan="2"></td><td colspan="2">A decrease in ECTS points from 7 to 5 is requested, because the previous number of ECTS points did not correspond to the point value of the course.</td></tr>
</table>

DESCRIPTION OF AMENDMENTS AND MODIFICATIONS TO UNDERGRADUATE, GRADUATE AND INTEGRATED UNDERGRADUATE AND GRADUATE STUDY PROGRAMMES

<table>
<tr><td>2.8. Student obligations</td><td colspan="12">Independently create a geological map of a specific area, create a field diary and a detailed sedimentological column.</td><td colspan="12">Actively participate in conducting field classes, keep a field diary, create a detailed sedimentological column and final report.</td></tr>
<tr><td rowspan="6">2.9. Monitoring student work</td><td>Class attendance</td><td></td><td>NO</td><td>Research</td><td></td><td>NO</td><td>Oral exam</td><td></td><td>NO</td><td>Class attendance</td><td>YES</td><td></td><td>Research</td><td></td><td>NO</td><td>Oral exam</td><td></td><td>NO</td></tr>
<tr><td>Experimental work</td><td></td><td>NO</td><td>Report</td><td></td><td>NO</td><td>(other)</td><td></td><td>NO</td><td>Experimental work</td><td></td><td>NO</td><td>Report</td><td>YES</td><td></td><td>Final report</td><td>YES</td><td></td></tr>
<tr><td>Essay</td><td></td><td>NO</td><td>Seminar paper</td><td></td><td>NO</td><td>(other)</td><td></td><td>NO</td><td>Essay</td><td></td><td>NO</td><td>Seminar paper</td><td></td><td>NO</td><td>(other)</td><td></td><td>NO</td></tr>
<tr><td>Preliminary exam</td><td></td><td>NO</td><td>Practical work</td><td>YES</td><td></td><td>(other)</td><td></td><td>NO</td><td>Preliminary exam</td><td></td><td>NO</td><td>Practical work</td><td>YES</td><td></td><td>(other)</td><td></td><td>NO</td></tr>
<tr><td>Project</td><td></td><td>NO</td><td>Written exam</td><td></td><td>NO</td><td>ECTS (total)</td><td colspan="2">7</td><td>Project</td><td></td><td>NO</td><td>Written exam</td><td></td><td>NO</td><td>ECTS (total)</td><td colspan="2">5</td></tr>
<tr><td rowspan="8">2.10. Required literature (available in the library and/or via other media)</td><td colspan="4">Title</td><td colspan="3">Number of copies in the library</td><td colspan="3">Availability via other media</td><td colspan="4">Title</td><td colspan="3">Number of copies in the library</td><td colspan="3">Availability via other media</td></tr>
<tr><td colspan="4"></td><td colspan="3"></td><td colspan="3"></td><td colspan="4">Thorpe, R. Brown, G. (1985): The field description of igneous rocks, Geological Society of London Handbook, 154 p.</td><td colspan="3">YES</td><td colspan="3">YES</td></tr>
<tr><td colspan="4"></td><td colspan="3"></td><td colspan="3"></td><td colspan="4">Fry, N. (1984): The field description of metamorphic rocks, Geological Society of London Handbook, 110 p.</td><td colspan="3">YES</td><td colspan="3">YES</td></tr>
<tr><td colspan="4"></td><td colspan="3"></td><td colspan="3"></td><td colspan="4">Freeman, T. (1999): Procedures in field geology, Blackwell Science, 95 p.</td><td colspan="3">YES</td><td colspan="3">YES</td></tr>
<tr><td colspan="4"></td><td colspan="3"></td><td colspan="3"></td><td colspan="4">Tucker, M. E. (1996): Sedimentary rocks in the field. John Wiley & Sons, 153 p.</td><td colspan="3">YES</td><td colspan="3">YES</td></tr>
<tr><td colspan="4"></td><td colspan="3"></td><td colspan="3"></td><td colspan="4"></td><td colspan="3"></td><td colspan="3"></td></tr>
<tr><td colspan="4"></td><td colspan="3"></td><td colspan="3"></td><td colspan="4"></td><td colspan="3"></td><td colspan="3"></td></tr>
<tr><td>2.11. Optional literature</td><td colspan="12"></td><td colspan="12">Other scientific papers related to the topic and/or area where the field teaching is conducted. Field trip guidebooks and basic geological maps with explanatory notes.</td></tr>
</table>

DESCRIPTION OF AMENDMENTS AND MODIFICATIONS TO UNDERGRADUATE, GRADUATE AND INTEGRATED UNDERGRADUATE AND GRADUATE STUDY PROGRAMMES

Table 2B Description of the course that was amended and/or modified – Geological Mapping

1. COURSE DECRIPTION – GENERAL INFORMATION		
	Before the modification	**After the modification**
1.1. Course teacher	Associate Professor Borna Lužar-Oberiter, PhD	Associate Professor Borna Lužar-Oberiter, PhD
1.2. Name of the course	Geological Mapping I	**Geological Mapping**
1.3. Associate teachers		**Iva Olić, mag. geol.**
1.4. Study programme (undergraduate, graduate, integrated)	Undergraduate	Undergraduate
1.5. Status of the course	Mandatory	Mandatory
1.6. Year of the study	3rd	3rd
1.7. ECTS credits	6	**5**
1.8. Type of instruction (number of hours L + E + S + e-learning)	15 + 90 + 0 + 0	**30 + 45** + 0 + 0
1.9. Expected enrolment in the course	30 – 35	**30**
1.10. Level of application of e-learning (level 1, 2, 3), percentage of online instruction (max. 20%)		**Level 1, up to 5 %**
2.1. Course objectives	Learning how to use geological maps and make new geological maps.	**Train students to read and interpret data from geological maps. Train students for geometric reconstruction and visualization of rock units and geological structures in three dimensions through practical cartographic exercises and programs.**
2.2. Course enrolment requirements and/or entry competences required for the course	Pass all exams of previous years of study	**Passed courses Physical Geology, Sedimentary Petrology, Igneous Petrology, Metamorphic Petrology, Historical Geology I, Historical Geology II and Invertebrate Paleontology**
2.3. Learning outcomes at the level of the programme to which the course contributes	Educating students for spatial understanding of geological structures and their presentation on geological maps, providing skills for understanding of geological composition of individual territories as well as skills for interpretation of geological evolution	**1) Recognise and apply basic and specific knowledge related to the fundamental laws of natural science in the interpretation of geological processes.**

	of the territories. Skills for integration of all geological knowledge on studied areas.	**2) Identify basic geological processes and geological materials, and connect them with the development of life on Earth and Earth itself.** **3) Identify simple geological problems and suggest possible solutions.** **4) Select and use suitable geological methods and specific technologies in solving geological problems.** **5) Use geological maps, domestic and foreign literature and databases, as well as other sources of information.**
2.4. Expected learning outcomes at the level of the course (3-10 learning outcomes)	Mastering reading geological maps, competences for construction of geological sections and 3-D diagrams, writing explanatory books of geological maps, mastering field geological mapping.	**1) State what a geological map is and distinguish between types of geological maps** **2) Identify lithostratigraphic units and create a geological log** **3) Recognize and apply appropriate symbols in the cartographic representation of geological structures** **4) Show geological structures in 3D space using structural contour lines** **5) Construct a geological boundary on a topographical base map** **6) Determine the thickness of a stratigraphic unit based on cartographic data** **7) Identify and reconstruct the geometry of geological structures based on map dana** **8) Construct a geological profile using an appropriate scale**
2.5. Course content (syllabus)	Introduction and history of geological mapping. Types of geological maps. Relations between rocks: structures, textures and tectonic movements, thickness of divided geological units. Recognition of geological structures on the geological maps and on the field. Graphical presentation geological structures (profiles, diagrams). Preparations for geological mapping (fotogeology, remote sensing). Field work. Cabinet work (analysis of the rocks, geological columns and profiles, explanatory notes). Special maps.	**1) Geological map – definition, types of maps, history** **2) Stratigraphic units on geological maps, lithostratigraphic classification and definition of formations** **3) Primary stratigraphic relationships and types of geological boundaries** 4) Geological log 5) Topographic base map 6) **Topographic and structure contours** **7) Flat geological surfaces in 3D space and on a map** 8) Geological cross section 9) Apparent angle 10) Thickness of stratigraphic units **11) Angular nonconformities in space and on a map** **12) Curved geological surfaces in space and on a map**

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<table>
<tr><td></td><td colspan="9"></td><td colspan="9">13) Faults in space and on a map
14) Folds in space and on a map
15) Geological mapping methods</td></tr>
<tr><td>2.6. Format of instruction:</td><td colspan="9">☒ lectures
☐ seminars and workshops
☒ exercises
☐ online in entirety
☒ partial e-learning
☐ field work

☐ independent assignments
☐ multimedia and the internet
☐ laboratory
☐ work with mentor
☐ (other)</td><td colspan="9">☒ lectures
☐ seminars and workshops
☒ exercises
☐ online in entirety
☐ partial e-learning
☐ field work

☒ independent assignments
☐ multimedia and the internet
☐ laboratory
☐ work with mentor
☐ (other)</td></tr>
<tr><td>2.7. Comments:</td><td colspan="9"></td><td colspan="9">A decrease in ECTS points from 6 to 5 is requested, and modification of the type of instruction (a change of number of lecture hours from 15 to 30, and exercise hours from 90 to 45).

During exercises students solve a large number of cartographic exercises and independently create individualized cartographic projects.</td></tr>
<tr><td>2.8. Student obligations</td><td colspan="9">Regular attending to lectures and successful passing all exercises</td><td colspan="9">Regular attendance of lectures and exercises, active participation in class, writing exams, timely turning in of projects and solving exercises.</td></tr>
<tr><td rowspan="5">2.9. Monitoring student work</td><td>Class attendance</td><td>YES</td><td></td><td>Research</td><td></td><td>NO</td><td>Oral exam</td><td></td><td>NO</td><td>Class attendance</td><td>YES</td><td></td><td>Research</td><td></td><td>NO</td><td>Oral exam</td><td></td><td>NO</td></tr>
<tr><td>Experimental work</td><td></td><td>NO</td><td>Report</td><td></td><td>NO</td><td>(other)</td><td></td><td>NO</td><td>Experimental work</td><td></td><td>NO</td><td>Report</td><td></td><td>NO</td><td>Cartographic exercises</td><td>YES</td><td></td></tr>
<tr><td>Essay</td><td></td><td>NO</td><td>Seminar paper</td><td></td><td>NO</td><td>(other)</td><td></td><td>NO</td><td>Essay</td><td></td><td>NO</td><td>Seminar paper</td><td></td><td>NO</td><td>(other)</td><td></td><td>NO</td></tr>
<tr><td>Preliminary exam</td><td>YES</td><td></td><td>Practical work</td><td>YES</td><td></td><td>(other)</td><td></td><td>NO</td><td>Preliminary exam</td><td>YES</td><td></td><td>Practical work</td><td>YES</td><td></td><td>(other)</td><td></td><td>NO</td></tr>
<tr><td>Project</td><td></td><td>NO</td><td>Written exam</td><td>YES</td><td></td><td>ECTS (total)</td><td>6</td><td></td><td>Project</td><td></td><td>NO</td><td>Written exam</td><td>YES</td><td></td><td>ECTS (total)</td><td>5</td><td></td></tr>
<tr><td rowspan="2">2.10. Required literature (available in the library and/or via other media)</td><td colspan="3">Title</td><td>Number of copies in the library</td><td colspan="2">Availability via other media</td><td colspan="3">Title</td><td>Number of copies in the library</td><td colspan="2">Availability via other media</td></tr>
<tr><td colspan="3">Barnes, J.M., Lisle, R.J. (2004): Basic Geological Mapping (fourth edition), John Wiley & Sons, Ltd, England</td><td></td><td colspan="2"></td><td colspan="3">Lisle, R.J. (2004): Geological Structures and Maps: A practical guide, 3rd Edition, Elsevir, Amsterdam, 106 p.</td><td>YES</td><td colspan="2">YES</td></tr>
</table>

DESCRIPTION OF AMENDMENTS AND MODIFICATIONS TO UNDERGRADUATE, GRADUATE AND INTEGRATED UNDERGRADUATE AND GRADUATE STUDY PROGRAMMES

	Bennison, G.M., Moseley, K.A. (1997): *An Introduction to Geological Structures & Maps*, Arnold, a member of the Hodder Headline Group, London			**Bennison, G.M., Olver, P.A., Moseley, K.A. (2011): *An Introduction to Geological Structures & Maps, 8th Edition*, Routledge, Taylor & Francis Group, London. 184 p.**	**YES**	**YES**
	Bahun, S. (1993): *Geološko kartiranje*, Školska knjiga, Zagreb			Bahun, S. (1993): *Geološko kartiranje*, Školska knjiga, Zagreb	YES	NO
	Butler, B.C.M., Bell, J.D. (1988): *Interpretation of Geological Maps*, Longman Scientific & Technical			**Powell, D. (1992): *Interpretation of Geological Structures Trough Maps: an introductory practical manual*, Longman Scientific & Technical. 176 p.**	**YES**	**NO**
	Bolton, T., Proudlove, P. (1989): *Geological Maps*, Cambridge Univ. Press					
2.11. Optional literature	Dimitrijević, M. (1978): *Geološko kartiranje*, ICS, Beograd, 486 p. Powell, D. (1994): *Interpretation of Geological Structures Trough Maps (an introductory practical manual),* Longman Scientific & Technical, Group UK Ltd.			Dimitrijević, M.D. (1978): *Geološko kartiranje*, ICS, Beograd, 486 p. **Simpson, B. (1968): *Geological maps*, Pergamon, Oxford. 98 p.** **Korbar et al. (2012): *Upute za izradu Osnovne geološke karte Republike Hrvatske M 1:50000*, Hrvatski geološki institut, Zagreb, 132 p.**		

DESCRIPTION OF AMENDMENTS AND MODIFICATIONS TO UNDERGRADUATE, GRADUATE AND INTEGRATED UNDERGRADUATE AND GRADUATE STUDY PROGRAMMES

Table 2B Description of the course that was amended and/or modified – Structural Geology and Tectonics

1. COURSE DECRIPTION – GENERAL INFORMATION		
	Before the modification	**After the modification**
1.1. Course teacher	Associate Professor Bojan Matoš, PhD	Associate Professor Bojan Matoš, PhD
1.2. Name of the course	Structural Geology and Tectonics	Structural Geology and Tectonics
1.3. Associate teachers	Iva Olić, mag. geol. (teaching assistant)	Iva Olić, mag. geol. (teaching assistant)
1.4. Study programme (undergraduate, graduate, integrated)	Undergraduate	Undergraduate
1.5. Status of the course	Mandatory	Mandatory
1.6. Year of the study	3rd	3rd
1.7. ECTS credits	5	5
1.8. Type of instruction (number of hours L + E + S + e-learning)	30 + 30 + 0 + 0	30 + 30 + 0 + 0
1.9. Expected enrolment in the course	20	20
1.10. Level of application of e-learning (level 1, 2, 3), percentage of online instruction (max. 20%)	Level 1	**Level 2, up to 20 %**
2.1. Course objectives	To acquire basic knowledge in structural geology and tectonics about the common types of deformational structures in rocks, about their genesis/evolution and methods used in descriptive, kinematic and dynamic structural analysis of rocks.	To acquire basic knowledge in structural geology and tectonics about the common types of deformational structures in rocks, about their genesis/evolution and methods used in descriptive, kinematic and dynamic structural analysis of rocks.
2.2. Course enrolment requirements and/or entry competences required for the course	Enrolment in undergraduate study of Geology with completed or passed courses: Physical Geology (passed) Historical Geology I (passed) Historical Geology II (passed) Geophysics (passed) Petrology of magmatic and metamorphic rocks (completed) Sedimentary Petrology (completed)	Enrolment in undergraduate study of Geology with completed or passed courses: Physical Geology (passed) Historical Geology I (passed) Historical Geology II (passed) Geophysics (passed) **Igneous Petrology (completed)** **Metamorphic Petrology (completed)** Sedimentary Petrology (completed)

DESCRIPTION OF AMENDMENTS AND MODIFICATIONS TO UNDERGRADUATE, GRADUATE AND INTEGRATED UNDERGRADUATE AND GRADUATE STUDY PROGRAMMES

2.3. Learning outcomes at the level of the programme to which the course contributes	1) Apply basic principles and laws in the field of natural, informatics and technical sciences in mining, geotechnics and environmental protection 2) Apply basic principles and laws from geology and geological engineering in mining, geotechnics and environmental protection 3) Use geological maps and data, situation maps and mining works development map and other engineering bases 4) Prepare and conduct laboratory and field research work	**1) Recognise and apply basic and specific knowledge related to the fundamental laws of natural science in the interpretation of geological processes.** **2) Identify simple geological problems and suggest possible solutions.** **3) Select and use suitable geological methods and specific technologies in solving geological problems.** **4) Apply information technologies (IT) when processing and presenting data.** **5) Use geological maps, domestic and foreign literature and databases, as well as other sources of information.** **6) Conduct field research independently or in a group and collect, describe and classify geological samples.** **7) Communicate and discuss ideas and solutions of geological problems with colleagues and experts.** **8) Design and generate simple geological models.** **9) Recognise the role of geology in knowledge development, valuation of goods, spatial arrangement, improvement of life quality and environmental preservation.**
2.4. Expected learning outcomes at the level of the course (3-10 learning outcomes)	1) To describe behaviour of rocks subjected to stress in different conditions of confining pressure, strain rate, pore fluid pressure and temperature 2) To describe types of deformational structures in rocks and their structural elements presented on geological maps, 3) To present orientation of structures and structural elements in stereographic projection 4) To calculate orientation of the principal stress axes based on fault slip data 5) To identify types of deformational foliations and lineations in rocks on selected templates (outcrop images) 6) To construct structural-geological cross-section based on available structural and geological data 7) To measure orientation of structural elements using geological compass and construct field sketches of rock outcrops 8) To identify deformation structures in field, conducting preliminary descriptive and kinematic analysis of fractures, faults and folds.	1) To describe behaviour of rocks subjected to stress in different conditions of confining pressure, strain rate, pore fluid pressure and temperature 2) To describe types of deformational structures in rocks and their structural elements presented on geological maps, 3) To present orientation of structures and structural elements in stereographic projection 4) To calculate orientation of the principal stress axes based on fault slip data 5) To identify types of deformational foliations and lineations in rocks on selected templates (outcrop images) 6) To construct structural-geological cross-section based on available structural and geological data 7) To measure orientation of structural elements using geological compass and construct field sketches of rock outcrops 8) To identify deformation structures in field, conducting preliminary descriptive and kinematic analysis of fractures, faults and folds.

DESCRIPTION OF AMENDMENTS AND MODIFICATIONS TO UNDERGRADUATE, GRADUATE AND INTEGRATED UNDERGRADUATE AND GRADUATE STUDY PROGRAMMES

2.5. Course content (syllabus)	L1. Introduction to the course, description of different types of stress regime in Earth's crust and their spatial arrangement Ex1. Principles of stereographic projection of lines and planes. Solution to exercise programmes 1 and 2. L2. Behaviour of rocks subjected to stress in different conditions of confining pressure, strain rate, pore fluid pressure and temperature Ex 2. Principles of stereographic projection of lines that lie upon a plane. Solution to exercise programme 3. L3. Basic principles in descriptive, kinematic and dynamic structural analysis of rocks and rock bodies. Ex 3. Use of stereographic projection in solution of most common problems in Structural geology. Solution to exercise programme 4. L4. Concepts of homogeneous and heterogeneous deformation in rocks by pure and simple shear. Ex 4. Rotation of lines and planes in stereographic projection. Solution to most common problems in Structural geology. L5. Analysis of joints and fractures in rocks: morphology of joint surfaces and associated structures. Ex 5. Mid-term exam No. 1. L6. Genetic classification of joints and fractures in rocks: classification of joints and fractures in respect to faults and folds. Ex. 6. Descriptive structural analysis of joints and fractures. Solution to exercise programmes 5 and 6. L7. Rock mechanics in Structural Geology and dynamic structural analysis of joints and faults. Ex. Calculation of principal stress axes orientation from fault slip data. Solution to exercise programme 7.	L1. Introduction to the course, description of different types of stress regime in Earth's crust and their spatial arrangement Ex1. Principles of stereographic projection of lines and planes. Solution to exercise programmes 1 and 2. L2. Behaviour of rocks subjected to stress in different conditions of confining pressure, strain rate, pore fluid pressure and temperature Ex 2. Principles of stereographic projection of lines that lie upon a plane. Solution to exercise programme 3. L3. Basic principles in descriptive, kinematic and dynamic structural analysis of rocks and rock bodies. Ex 3. Use of stereographic projection in solution of most common problems in Structural geology. Solution to exercise programme 4. L4. Concepts of homogeneous and heterogeneous deformation in rocks by pure and simple shear. Ex 4. Rotation of lines and planes in stereographic projection. Solution to most common problems in Structural geology. L5. Analysis of joints and fractures in rocks: morphology of joint surfaces and associated structures. Ex 5. Mid-term exam No. 1. L6. Genetic classification of joints and fractures in rocks: classification of joints and fractures in respect to faults and folds. Ex. 6. Descriptive structural analysis of joints and fractures. Solution to exercise programmes 5 and 6. L7. Rock mechanics in Structural Geology and dynamic structural analysis of joints and faults. Ex. Calculation of principal stress axes orientation from fault slip data. Solution to exercise programme 7. L8. Faults (part 1): Classification of faults, recognizing appearance and expression of faults on surface and in subsurface, on geological maps and seismic sections.

	L8. Faults (part 1): Classification of faults, recognizing appearance and expression of faults on surface and in subsurface, on geological maps and seismic sections. Ex. 8. Interpretation of faults on seismic sections. Solution to exercise programmes 8 and 9. L9. Faults (part 2): Structural properties of fault rocks, geometry of faults and fault systems, principles and methods to estimate time of fault activity. Ex. 9. Interpretation of faults on seismic sections. Solution to exercise programme 10. L10. Folds (part 1): Descriptive structural analysis of folds, folds geometry and classification. Ex. 10. Mid-term exam No. 2. L11. Folds (part 2): Order and types of folds and folding mechanism in compressional tectonics. Ex. 11. Descriptive analysis of folds. Solution to exercise programme 11. L12. Foliations and lineations in tectonites (part 1): Types of foliations and lineations in tectonites. Ex. 12. Descriptive analysis of foliations based on microphotographs (solution to exercise programme 12). P13. Foliations and lineations in tectonites (part 2): Deformational foliations in folded rocks. Ex. 13. Descriptive analysis of foliations based on microphotographs (solution to exercise programme 13). L14. Preparation for the field work: structural analysis and tectonic characteristics of a study area Ex. 14. Mid-term exam No. 3. L15. and Ex.15 Structural geology fieldwork - (2 field days)		Ex. 8. Interpretation of faults on seismic sections. Solution to exercise programmes 8 and 9. L9. Faults (part 2): Structural properties of fault rocks, geometry of faults and fault systems, principles and methods to estimate time of fault activity. Ex. 9. Interpretation of faults on seismic sections. Solution to exercise programme 10. L10. Folds (part 1): Descriptive structural analysis of folds, folds geometry and classification. Ex. 10. Mid-term exam No. 2. L11. Folds (part 2): Order and types of folds and folding mechanism in compressional tectonics. Ex. 11. Descriptive analysis of folds. Solution to exercise programme 11. L12. Foliations and lineations in tectonites (part 1): Types of foliations and lineations in tectonites. Ex. 12. Descriptive analysis of foliations based on microphotographs (solution to exercise programme 12). P13. Foliations and lineations in tectonites (part 2): Deformational foliations in folded rocks. Ex. 13. Descriptive analysis of foliations based on microphotographs (solution to exercise programme 13). L14. Preparation for the field work: structural analysis and tectonic characteristics of a study area Ex. 14. Mid-term exam No. 3. L15. and Ex.15 Structural geology fieldwork - (2 field days)	
2.6. Format of instruction:	☒ lectures	☒ independent	☒ lectures	☒ independent

DESCRIPTION OF AMENDMENTS AND MODIFICATIONS TO UNDERGRADUATE, GRADUATE AND INTEGRATED UNDERGRADUATE AND GRADUATE STUDY PROGRAMMES

<table>
<tr><td></td><td>☐ seminars and workshops
☒ exercises
☐ online in entirety
☐ partial e-learning
☒ field work</td><td>☐ assignments
☐ multimedia and the internet
☐ laboratory
☐ work with mentor
☐ (other)</td><td>☐ seminars and workshops
☒ exercises
☐ online in entirety
☐ partial e-learning
☒ field work</td><td>☐ assignments
☐ multimedia and the internet
☐ laboratory
☐ work with mentor
☐ (other)</td></tr>
<tr><td>2.7. Comments:</td><td></td><td></td><td></td><td></td></tr>
<tr><td>2.8. Student obligations</td><td colspan="2">Students are expected to attend in classes (70 % of lectures and exercises), submit exercise programs, participate in course fieldwork.
Course final exam obligations and student course grading procedure:
- submitted exercise programs, written exam (positively graded Mid-term exams), oral exam
Exercise modus: project exercises – project programs</td><td colspan="2">Students are expected to attend in classes (70 % of lectures and exercises), submit exercise programs, participate in course fieldwork.
Course final exam obligations and student course grading procedure:
- submitted exercise programs, written exam (positively graded Mid-term exams), oral exam
Exercise modus: project exercises – project programs</td></tr>
<tr><td>2.9. Monitoring student work</td><td colspan="2">
<table>
<tr><td>Class attendance</td><td>YES</td><td></td><td>Research</td><td></td><td>NO</td><td>Oral exam</td><td>YES</td><td></td></tr>
<tr><td>Experimental work</td><td></td><td>NO</td><td>Report</td><td></td><td>NO</td><td>(other)</td><td></td><td>NO</td></tr>
<tr><td>Essay</td><td></td><td>NO</td><td>Seminar paper</td><td></td><td>NO</td><td>(other)</td><td></td><td>NO</td></tr>
<tr><td>Preliminary exam</td><td>YES</td><td></td><td>Practical work</td><td>YES</td><td></td><td>(other)</td><td></td><td>NO</td></tr>
<tr><td>Project</td><td></td><td>NO</td><td>Written exam</td><td>YES</td><td></td><td>ECTS (total)</td><td>5</td><td></td></tr>
</table>
</td><td colspan="2">
<table>
<tr><td>Class attendance</td><td>YES</td><td></td><td>Research</td><td></td><td>NO</td><td>Oral exam</td><td>YES</td><td></td></tr>
<tr><td>Experimental work</td><td></td><td>NO</td><td>Report</td><td></td><td>NO</td><td>(other)</td><td></td><td>NO</td></tr>
<tr><td>Essay</td><td></td><td>NO</td><td>Seminar paper</td><td></td><td>NO</td><td>(other)</td><td></td><td>NO</td></tr>
<tr><td>Preliminary exam</td><td>YES</td><td></td><td>Practical work</td><td>YES</td><td></td><td>(other)</td><td></td><td>NO</td></tr>
<tr><td>Project</td><td></td><td>NO</td><td>Written exam</td><td>YES</td><td></td><td>ECTS (total)</td><td>5</td><td></td></tr>
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</td></tr>
<tr><td>2.10. Required literature (available in the library and/or via other media)</td><td colspan="2">
<table>
<tr><th>Title</th><th>Number of copies in the library</th><th>Availability via other media</th></tr>
<tr><td>Matoš B. (2021): Course materials available on MERLIN platform</td><td>NO</td><td>YES</td></tr>
<tr><td>Fossen, H. (2010): Structural Geology, Cambridge Uni. Press, 463 p. (selected chapters)</td><td>YES</td><td>NO</td></tr>
<tr><td></td><td></td><td></td></tr>
<tr><td></td><td></td><td></td></tr>
<tr><td></td><td></td><td></td></tr>
</table>
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<tr><th>Title</th><th>Number of copies in the library</th><th>Availability via other media</th></tr>
<tr><td>Matoš B. (2021): course materials available on MERLIN platform</td><td>NO</td><td>YES</td></tr>
<tr><td>Fossen, H. (2010): Structural Geology, Cambridge Uni. Press, 463 p. (selected chapters)</td><td>YES</td><td>NO</td></tr>
<tr><td></td><td></td><td></td></tr>
<tr><td></td><td></td><td></td></tr>
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DESCRIPTION OF AMENDMENTS AND MODIFICATIONS TO UNDERGRADUATE, GRADUATE AND INTEGRATED UNDERGRADUATE AND GRADUATE STUDY PROGRAMMES

2.11. Optional literature						

DESCRIPTION OF AMENDMENTS AND MODIFICATIONS TO UNDERGRADUATE, GRADUATE AND INTEGRATED UNDERGRADUATE AND GRADUATE STUDY PROGRAMMES

Table 2B Description of the course that was amended and/or modified – Introduction to Geographic Information systems

1. COURSE DECRIPTION – GENERAL INFORMATION		
	Before the modification	**After the modification**
1.1. Course teacher	Associate Professor Borna Lužar-Oberiter, PhD	Associate Professor Borna Lužar-Oberiter, PhD
1.2. Name of the course	Software in geology	**Introduction to geographic information systems**
1.3. Associate teachers	Laura Posarić, Mag. Ing. Geol.	Laura Posarić, Mag. Ing. Geol.
1.4. Study programme (undergraduate, graduate, integrated)	Undergraduate	Undergraduate
1.5. Status of the course	Mandatory	**Elective**
1.6. Year of the study	3rd	3rd
1.7. ECTS credits	5	5
1.8. Type of instruction (number of hours L + E + S + e-learning)	30 + 30 + 0 + 0	30 + 30 + 0 + 0
1.9. Expected enrolment in the course	30 – 35	30 – 35
1.10. Level of application of e-learning (level 1, 2, 3), percentage of online instruction (max. 20%)	Level 1, up to 10 %	Level 1, up to 10 %
2.1. Course objectives	The aim of the course is to acquaint students with principles in spatial data collections, input, editing, processing, and visualization. The course provides an opportunity for students to use geology-related software	**Familiarize students with geographic information systems and basic tools for collection, input, editing, analysing and displaying of spatial data. Provide students with practical experience in working with computer programs that are widely used in geology.**
2.2. Course enrolment requirements and/or entry competences required for the course	Recommended: basic computer skills (MS Windows operating system).	Recommended: basic computer skills (MS Windows operating system).
2.3. Learning outcomes at the level of the programme to which	The course will familiarize students with the basic concepts and practices of geology-related software.	**1) Select and use suitable geological methods and specific technologies in solving geological problems.** **2) Apply information technologies (IT) when processing and presenting data.**

DESCRIPTION OF AMENDMENTS AND MODIFICATIONS TO UNDERGRADUATE, GRADUATE AND INTEGRATED UNDERGRADUATE AND GRADUATE STUDY PROGRAMMES

the course contributes		**3) Perform relevant experiments and analyses independently or in a group and present data using suitable qualitative and quantitative methods.** **4) Use geological maps, domestic and foreign literature and databases, as well as other sources of information.** **5) Identify problems related to sampling and data processing in field and laboratory research.**
2.4. Expected learning outcomes at the level of the course (3-10 learning outcomes)	Knowledge of the fundamentals of GIS theory and applications Understanding of GIS data structures (vector and raster) Basic knowledge about map projections. Understanding the database structure relations and the concept of data modelling. Improving skills related to searching and collecting spatial data. Basic knowledge in MS-Office Suite (Word, Excel, PowerPoint, FrontPage and Access) Theoretical and working knowledge of ArcGIS (ESRI) – editing and georeferencing of raster data, editing of vector data, adding data, working with tables and attributes, querying data, creating of maps, charts and reports.	**Students will be able to** **1) State what a geographic information system is, what are its components, and list its basic functions. List areas of application and tools for working with spatial data.** **2) Describe the structure of vector and raster data models. Recognize types of entities and choose the appropriate data model.** **3) Explain basic concepts of geodesy and mathematical cartography (Earth ellipsoid, Geoid, geodetic datum, coordinates, map projections). Explain the problem of defining the geographic position on a curved Earth surface and on a map.** **4) Collect coordinate data using global satellite navigation systems.** **5) Georeference and reproject cartographic data.** **6) Create and edit vector data.** **7) Connect spatial data with attribute data and databases.** **8) Research, select and collect spatial data available through government services and online repositories.** **9) Choose a method and perform interpolation on a set of point data.** **10) Perform basic spatial operations on raster data.**
2.5. Course content (syllabus)	1) Introduction to MS Word and MS Excel 2) Introduction to MS PowerPoint and MS FrontPage 3) Introduction to MS Access 4) Introduction to GIS 5) Spatial data collection – sources and availability 6) Spatial data models 7) Principles of the map projections 8) Database	**1) Introduction to GIS – definition, historical overview, areas of application, basic tools** 2) Spatial data models **3) Defining position - historical development, Earth ellipsoid, Geoid, geodetic datum, coordinate systems** **4) Cartographic projections** **5) Coordinate transformations**

DESCRIPTION OF AMENDMENTS AND MODIFICATIONS TO UNDERGRADUATE, GRADUATE AND INTEGRATED UNDERGRADUATE AND GRADUATE STUDY PROGRAMMES

<table>
<tr><td></td><td colspan="9">9) Work with raster data
10) Work with vector data
11) Work with tables and attributes
12) Query of spatial data
13) Visualization of spatial data
14-15) Individual projects</td><td colspan="9">6) Data sources - collection, input and digitizing, maps as a data source
7) Global navigation satellite systems
8) Remote sensing
9) Basics of databases, attribute data and tables
10) Basics of spatial data analysis
11) Interpolation and prediction methods
12) Analysis of raster data
13) Modelling of cartographic data
14-15) Project</td></tr>
<tr><td>2.6. Format of instruction:</td><td colspan="5">☒ lectures
☐ seminars and workshops
☒ exercises
☐ online in entirety
☐ partial e-learning
☐ field work</td><td colspan="4">☐ independent assignments
☒ multimedia and the internet
☒ laboratory
☐ work with mentor
☐ (other)</td><td colspan="5">☒ lectures
☐ seminars and workshops
☒ exercises
☐ online in entirety
☐ partial e-learning
☐ field work</td><td colspan="4">☒ independent assignments
☒ multimedia and the internet
☒ laboratory
☐ work with mentor
☐ (other)</td></tr>
<tr><td>2.7. Comments:</td><td colspan="9">Exercises are performed through practical work in computer laboratory.</td><td colspan="9">Exercises are performed through practical work in computer laboratory.</td></tr>
<tr><td>2.8. Student obligations</td><td colspan="9">To attend the classes and to pass the tests.</td><td colspan="9">Regular attendance and active participation in classes, solving tasks.</td></tr>
<tr><td rowspan="5">2.9. Monitoring student work</td><td>Class attendance</td><td>YES</td><td></td><td>Research</td><td></td><td>NO</td><td>Oral exam</td><td>YES</td><td></td><td>Class attendance</td><td>YES</td><td></td><td>Research</td><td></td><td>NO</td><td>Oral exam</td><td></td><td>NO</td></tr>
<tr><td>Experimental work</td><td></td><td>NO</td><td>Report</td><td></td><td>NO</td><td>(other)</td><td></td><td>NO</td><td>Experimental work</td><td></td><td>NO</td><td>Report</td><td></td><td>NO</td><td>(other)</td><td></td><td>NO</td></tr>
<tr><td>Essay</td><td></td><td>NO</td><td>Seminar paper</td><td></td><td>NO</td><td>(other)</td><td></td><td>NO</td><td>Essay</td><td></td><td>NO</td><td>Seminar paper</td><td></td><td>NO</td><td>(other)</td><td></td><td>NO</td></tr>
<tr><td>Preliminary exam</td><td>YES</td><td></td><td>Practical work</td><td></td><td>NO</td><td>(other)</td><td></td><td>NO</td><td>Preliminary exam</td><td>YES</td><td></td><td>Practical work</td><td>YES</td><td></td><td>(other)</td><td></td><td>NO</td></tr>
<tr><td>Project</td><td>YES</td><td></td><td>Written exam</td><td>YES</td><td></td><td>ECTS (total)</td><td>5</td><td></td><td>Project</td><td>YES</td><td></td><td>Written exam</td><td>YES</td><td></td><td>ECTS (total)</td><td>5</td><td></td></tr>
<tr><td rowspan="2">2.10. Required literature (available in the library and/or via other media)</td><td colspan="3">Title</td><td colspan="2">Number of copies in the library</td><td colspan="3">Availability via other media</td><td colspan="3">Title</td><td colspan="3">Number of copies in the library</td><td colspan="3">Availability via other media</td></tr>
<tr><td colspan="3">Bonham-Carter, G.F. (1994): Geographic information systems for</td><td colspan="2">YES</td><td colspan="3">NO</td><td colspan="3">Bolstad, P. (2008): GIS Fundamentals: A First Text on Geographic Information</td><td colspan="3">YES</td><td colspan="3">YES</td></tr>
</table>

DESCRIPTION OF AMENDMENTS AND MODIFICATIONS TO UNDERGRADUATE, GRADUATE AND INTEGRATED UNDERGRADUATE AND GRADUATE STUDY PROGRAMMES

	geoscientists: Modelling with GIS. Computer methods in geosciences, Volume 13. Pergamon. 398 p.			***Systems, 3rd edition,* Paul Bolstad, 620 p.**		
	Syllabus material for lectures and exercises	NO	**YES**	**Huisman, O., De By, R.A. (Eds.) (2009): *Principles of Geographic Information Systems, ITC Educational Textbook Series, Fourth edition,* The International Institute for Geo-Information Science and Earth Observation, Enschede, 540 p. https://webapps.itc.utwente.nl/librarywww/papers_2009/** general/PrinciplesGIS.pdf	**NO**	**YES**
2.11. Optional literature	Varga, M. (1994): *Baze Podataka: Konceptualno, logičko i fizičko modeliranje podataka*. DRIP - Društvo za razvoj informacijske pismenosti, Zagreb. 217 p. Molenaar, M. (1998): *An Introduction to the Theory of Spatial Object Modelling*. Taylor & Francis, 200 p.			**Bonham-Carter, G.F. (1994): *Geographic information systems for geoscientists: Modelling with GIS. Computer methods in geosciences, Volume 13*. Pergamon. 398 p.**		

DESCRIPTION OF AMENDMENTS AND MODIFICATIONS TO UNDERGRADUATE, GRADUATE AND INTEGRATED UNDERGRADUATE AND GRADUATE STUDY PROGRAMMES

Table 2B Description of the course that was amended and/or modified – Phase and Elemental Analysis

1. COURSE DECRIPTION – GENERAL INFORMATION		
	Before the modification	**After the modification**
1.1. Course teacher	Full Professor Gordana Medunić, PhD, Associate Professor Hana Fajković, PhD	Full Professor Gordana Medunić, PhD, Associate Professor Hana Fajković, PhD
1.2. Name of the course	Phase and Elemental Analysis	Phase and Elemental Analysis
1.3. Associate teachers		**Zvonka Gverić, Mag. Geol., Štefica Kampić, Dipl. Ing.**
1.4. Study programme (undergraduate, graduate, integrated)	Undergraduate	Undergraduate
1.5. Status of the course	Mandatory	Mandatory
1.6. Year of the study	2nd	**3rd**
1.7. ECTS credits	5	5
1.8. Type of instruction (number of hours L + E + S + e-learning)	30 + 30 + 0 + 0	30 + 30 + 0 + 0
1.9. Expected enrolment in the course	36	36
1.10. Level of application of e-learning (level 1, 2, 3), percentage of online instruction (max. 20%)	Level 1, 0 %	Level 1, 0 %
2.1. Course objectives	Acquiring basic knowledge about sampling problems and the principles of elemental and phase analysis methods in order to gain knowledge about their possibilities and limitations	Acquiring basic knowledge about sampling problems and the principles of elemental and phase analysis methods in order to gain knowledge about their possibilities and limitations
2.2. Course enrolment requirements and/or entry competences required for the course	Passed the courses Chemistry I, Chemistry II and General Mineralogy.	**Passed courses Chemistry II and Geochemistry.**
2.3. Learning outcomes at the level of the programme to which the course contributes	1) Basic knowledge and understanding of the natural sciences (Physics, Chemistry, Biology, Mathematics) underlying the study of Geology	**1) Recognise and apply basic and specific knowledge related to the fundamental laws of natural science in the interpretation of geological processes.**

DESCRIPTION OF AMENDMENTS AND MODIFICATIONS TO UNDERGRADUATE, GRADUATE AND INTEGRATED UNDERGRADUATE AND GRADUATE STUDY PROGRAMMES

	2) Knowledge and understanding of the essential features, processes, materials, history and the development of the Earth and life 4) Knowledge of the common terminology and nomenclature and the use of bibliography in Geosciences 5) An awareness of the wider spectrum of geological disciplines 7) Awareness of the applications and responsibilities of Geology and its role in society including its environmental aspects 10) Appropriate knowledge of other disciplines relevant to geology 12) Some understanding of the complexity of geological problems and the feasibility of their solution 14) Basic ability in the formalisation and specification of problems whose solution involves the use of geological methods 15) Knowledge of appropriate solution patterns for geological problems 16) Basic ability to describe a solution at an abstract level 17) Knowledge of the range of applications of Geology 18) Ability to integrate field and laboratory evidence with theory following the sequence from observation to recognition, synthesis and modelling 19) Appreciation of issues concerning sample selection, accuracy, precision and uncertainty during collection, recording and analysis of data in the field and laboratory 21) Basic ability to become familiar with new geological methods and technologies 23) Ability to use simple quantitative methods and to apply them to geological problems 24) Basic ability to independently analyse earth materials in the field and laboratory and to describe, process, document and report the results 25) Ability to undertake field and lab investigation in a responsible and safe manner, paying due attention to risk assessment, rights of access, relevant health and safety regulations, and sensitivity to the impact of investigation on the environment and stakeholders	**4) Select and use suitable geological methods and specific technologies in solving geological problems.** **6) Perform relevant experiments and analyses independently or in a group and present data using suitable qualitative and quantitative methods.** **10) Identify problems related to sampling and data processing in field and laboratory research.** **15) Plan further professional development on the basis of acquired geological knowledge and developed specific skills**

DESCRIPTION OF AMENDMENTS AND MODIFICATIONS TO UNDERGRADUATE, GRADUATE AND INTEGRATED UNDERGRADUATE AND GRADUATE STUDY PROGRAMMES

	26) Basic ability to combine theory and practice to complete geological tasks 27) Ability to undertake literature searches, and to use data bases and other sources of information 28) Ability to receive and respond to a variety of information sources (e.g. textual, numerical, verbal, graphical) 29) Ability to conduct appropriate experiments, to analyse and interpret data and draw conclusions 30) Basic awareness of relevant state-of-the-art technologies and their application 31) Basic ability to solve numerical problems using computer and non-computer-based techniques 34) Ability to learn and study including effective time management and flexibility 35) Ability to work effectively as an individual and as a member of a team 36) Recognition of the need for, and engagement in self-managed and life-long learning 37) Ability to organise their own work independently 38) Basic ability to communicate effectively in written and verbal form with colleagues, other professionals, customers and the general public about substantive issues and problems related to their chosen specialisation	
2.4. Expected learning outcomes at the level of the course (3-10 learning outcomes)	1) Basic knowledge and understanding of natural sciences (physics, chemistry, biology, mathematics) essential for the study of geology. 2) Knowledge and understanding of the basic features, processes, materials, history and development of the Earth and life 3) Knowledge of basic terminology, nomenclature and bibliography in geosciences 4) Understanding the breadth of geological disciplines 5) Understanding the application and responsibility of geology and its role in society, including aspects of environmental protection 6) Adequate knowledge of other disciplines important in geology	**1) Apply methods and knowledge to the description of geological materials.** **2) Discuss the applicability of a particular method depending on the specific task.** **3) Recommend a suitable method for implementation depending on the material.** **4) Searching and using literature.**

	7) Basic understanding of the complexity of geological problems and the feasibility of their solutions 8) Basic ability to recognize and analyse problems whose solution involves the use of geological methods 9) Knowledge of appropriate procedures in solving geological problems 10) Basic ability to describe solutions on an abstract level 11) Knowledge of the range of application of geology 12) Ability to integrate field and laboratory evidence with theoretical knowledge through observation, recognition, synthesis and modelling 13) Understanding of issues related to sampling, accuracy, 14) precision and unknowns during data collection and analysis in field and laboratory research 15) Basic ability to adopt new geological methods and technologies 16) Ability to use simple quantitative methods and their application in geological problems 17) Basic ability to independently analyse natural materials in the field and in the laboratory in order to describe, process, document and present the results 18) Ability to undertake and lab investigations in a responsible and safe manner, paying attention to risk assessment, right of access, appropriate health and safety regulations, and sensitivity to the impact of investigations on the environment and individual interest groups 19) Basic ability to combine theory and practical work in performing geological tasks 20) Ability to search literature and use databases and other sources of information 21) Ability to receive and respond to different sources of information (e.g. textual, numerical, verbal and graphic) 22) Ability to conduct appropriate experiments, analyse and interpret data and draw conclusions 23) Basic understanding of appropriate modern technologies and their application	

DESCRIPTION OF AMENDMENTS AND MODIFICATIONS TO UNDERGRADUATE, GRADUATE AND INTEGRATED UNDERGRADUATE AND GRADUATE STUDY PROGRAMMES

<table>
<tr><td></td><td colspan="2">24) Basic ability to solve numerical problems using computer and non-computer techniques
25) Ability to learn and study with efficient use of time and flexibility
26) Ability to work effectively independently and in a team
27) Recognizing the need for self-learning and lifelong education
28) Ability to independently organize one's own work
29) Basic ability to effectively communicate in written and verbal form with colleagues, other experts, users of services and the public about the facts and problems of the chosen specialization</td><td colspan="2"></td></tr>
<tr><td>2.5. Course content (syllabus)</td><td colspan="2">1) Introduction, division and definitions of quantitative chemical analysis, numerical parameters of quantitative analysis, phases of quantitative analysis
2) Basics of sampling, basic statistical parameters
3) Preparation of samples for analysis, methods of dissolution and decomposition of the sample
4) Wet chemistry methods: gravimetric and titrimetric methods
5-6) Electromagnetic spectrum, spectrometric methods, absorption and emission methods, other methods
7) Electroanalytical methods, basics of redox reactions
8-9) Introduction to X-ray diffraction, spectrum of X-ray radiation, interaction of X-ray radiation and matter
11-12) Powder method, theory, instrumentation, qualitative phase analysis, working with databases, basics of quantitative analysis
13) X-ray fluorescence analysis
14) Fundamentals of electron microscopy
15) Thermal analysis</td><td colspan="2">1) Geoanalysis – elemental analysis of minerals.
2) Analytical chemistry and quantitative analysis - basic concepts.
3) Analytical system errors.
4) Performance characteristics of the chemical measurement process.
5) Gravimetric analysis.
6) Volumetric (or titrimetric) analysis.
7–8) Spectroscopic methods of analysis.
9) Electroanalytical methods, basics of redox reactions
10) Introduction to X-ray diffraction, spectrum of X-ray radiation, interaction of X-ray radiation and matter
11) Powder method, theory, instrumentation, qualitative phase analysis, work with databases, basics of quantitative analysis
12–13) X-ray fluorescence analysis
14) Fundamentals of electron microscopy
15) Thermal analysis</td></tr>
<tr><td>2.6. Format of instruction:</td><td>☒ lectures
☐ seminars and workshops
☒ exercises
☐ online in entirety
☐ partial e-learning
☐ field work</td><td>☐ independent assignments
☐ multimedia and the internet
☒ laboratory
☐ work with mentor
☐ (other)</td><td>☒ lectures
☐ seminars and workshops
☒ exercises
☐ online in entirety
☐ partial e-learning
☐ field work</td><td>☐ independent assignments
☐ multimedia and the internet
☒ laboratory
☐ work with mentor
☐ (other)</td></tr>
</table>

DESCRIPTION OF AMENDMENTS AND MODIFICATIONS TO UNDERGRADUATE, GRADUATE AND INTEGRATED UNDERGRADUATE AND GRADUATE STUDY PROGRAMMES

<table>
<tr><td>2.7. Comments:</td><td colspan="9"></td><td colspan="9">The transfer of the course from the III to the V semester is requested for a better sequence of course materials (i.e., to come after the course Geochemistry).</td></tr>
<tr><td>2.8. Student obligations</td><td colspan="9">Attending classes, preliminary exams, homework assignments</td><td colspan="9">Attending classes, preliminary exams, homework assignments</td></tr>
<tr><td rowspan="5">2.9. Monitoring student work</td><td>Class attendance</td><td>YES</td><td></td><td>Research</td><td></td><td>NO</td><td>Oral exam</td><td>YES</td><td></td><td>Class attendance</td><td>YES</td><td></td><td>Research</td><td></td><td>NO</td><td>Oral exam</td><td>YES</td><td></td></tr>
<tr><td>Experimental work</td><td>YES</td><td></td><td>Report</td><td></td><td>NO</td><td>(other)</td><td></td><td>NO</td><td>Experimental work</td><td>YES</td><td></td><td>Report</td><td></td><td>NO</td><td>(other)</td><td></td><td>NO</td></tr>
<tr><td>Essay</td><td></td><td>NO</td><td>Seminar paper</td><td></td><td>NO</td><td>(other)</td><td></td><td>NO</td><td>Essay</td><td></td><td>NO</td><td>Seminar paper</td><td></td><td>NO</td><td>(other)</td><td></td><td>NO</td></tr>
<tr><td>Preliminary exam</td><td>YES</td><td></td><td>Practical work</td><td></td><td>NO</td><td>(other)</td><td></td><td>NO</td><td>Preliminary exam</td><td>YES</td><td></td><td>Practical work</td><td></td><td>NO</td><td>(other)</td><td></td><td>NO</td></tr>
<tr><td>Project</td><td></td><td>NO</td><td>Written exam</td><td>YES</td><td></td><td>ECTS (total)</td><td colspan="2">5</td><td>Project</td><td></td><td>NO</td><td>Written exam</td><td>YES</td><td></td><td>ECTS (total)</td><td colspan="2">5</td></tr>
<tr><td rowspan="7">2.10. Required literature (available in the library and/or via other media)</td><td colspan="5">Title</td><td>Number of copies in the library</td><td>Availability via other media</td><td colspan="5">Title</td><td>Number of copies in the library</td><td>Availability via other media</td></tr>
<tr><td colspan="5">Skoog, D.A., West, D.M., Holler, F.J. (1999): Osnove analitičke kemije, Školska knjiga, Zagreb, 951 p.</td><td>YES</td><td>NO</td><td colspan="5">Skoog, D.A., West, D.M., Holler, F.J. (1999): Osnove analitičke kemije, Školska knjiga, Zagreb, 951 p.</td><td>YES</td><td>NO</td></tr>
<tr><td colspan="5">Whiston, C. (1987): X-ray metods, John Wiley & Sons, New York, 426 p.</td><td>YES</td><td>NO</td><td colspan="5">Whiston, C. (1987): X-ray metods, John Wiley & Sons, New York, 426 p.</td><td>YES</td><td>NO</td></tr>
<tr><td colspan="5">Skoog, D.A., Leary, J.J. (1992): Principles of instrumental analysis, Saunders College Publishing, Fort Worth, 700 p.</td><td>YES</td><td>NO</td><td colspan="5">Skoog, D.A., Leary, J.J. (1992): Principles of instrumental analysis, Saunders College Publishing, Fort Worth, 700 p.</td><td>YES</td><td>NO</td></tr>
<tr><td colspan="5"></td><td></td><td></td><td colspan="5"></td><td></td><td></td></tr>
<tr><td colspan="5"></td><td></td><td></td><td colspan="5"></td><td></td><td></td></tr>
<tr><td colspan="5"></td><td></td><td></td><td colspan="5"></td><td></td><td></td></tr>
<tr><td>2.11. Optional literature</td><td colspan="9">Jones, M.P. (1987): Applied mineralogy, Graham & Trotman, London, 259 p.</td><td colspan="9">Jones, M.P. (1987): Applied mineralogy, Graham & Trotman, London, 259 p.

Hage, D.S., Carr, J.D. (2011): Analytical chemistry and quantitative analysis, Pearson Prentice Hall, New Jersey, 696 p.

Hage, D.S., Carr, J.D. (2011): Student solutions manual, Pearson Prentice Hall, New Jersey, 436 p.</td></tr>
</table>

DESCRIPTION OF AMENDMENTS AND MODIFICATIONS TO UNDERGRADUATE, GRADUATE AND INTEGRATED UNDERGRADUATE AND GRADUATE STUDY PROGRAMMES

		Kaštelan-Macan, M. (2003): *Kemijska analiza u sustavu kvalitete,* Školska knjiga, Zagreb, 337 p.

DESCRIPTION OF AMENDMENTS AND MODIFICATIONS TO UNDERGRADUATE, GRADUATE AND INTEGRATED UNDERGRADUATE AND GRADUATE STUDY PROGRAMMES

Table 2B Description of the course that was amended and/or modified – Marine Geology

1. COURSE DECRIPTION – GENERAL INFORMATION		
	Before the modification	**After the modification**
1.1. Course teacher	Associate Professor Kristina Pikelj, PhD Assistant Professor Igor Felja, PhD	Associate Professor Kristina Pikelj, PhD Assistant Professor Igor Felja, PhD
1.2. Name of the course	Marine Geology	Marine Geology
1.3. Associate teachers		
1.4. Study programme (undergraduate, graduate, integrated)	Undergraduate	Undergraduate
1.5. Status of the course	Elective	**Mandatory**
1.6. Year of the study	3rd	3rd
1.7. ECTS credits	4	4
1.8. Type of instruction (number of hours L + E + S + e-learning)	30 + 30 + 0 + 0	30 + **15** + 0 + 0
1.9. Expected enrolment in the course	15	**20**
1.10. Level of application of e-learning (level 1, 2, 3), percentage of online instruction (max. 20%)	Level 1, up to 5 %	Level 1, **up to 3 %**
2.1. Course objectives	To acquaint students with the environment in which most of the sediments are formed. To highlight the connection between physical, chemical, biological and geological processes in the formation and diagenesis of sediment.	To acquaint students with the **marine** environment in which most of the **water** sediments are formed. To highlight the connection between physical, chemical, biological and geological processes in the formation and diagenesis of sediment.
2.2. Course enrolment requirements and/or entry competences required for the course	There are no particular requirements. Previous knowledge of general geology, mineralogy, biology, physics and chemistry is required.	There are no particular requirements. Previous knowledge of general **palaeontology**, geology, mineralogy, biology, physics and chemistry is required.
2.3. Learning outcomes at the level of the programme to which	Understanding of physical and chemical processes in the sea, and the influence of organisms on the formation and diagenesis of sediment.	**1) Recognise and apply basic and specific knowledge related to the fundamental laws of natural science in the interpretation of geological processes.**

DESCRIPTION OF AMENDMENTS AND MODIFICATIONS TO UNDERGRADUATE, GRADUATE AND INTEGRATED UNDERGRADUATE AND GRADUATE STUDY PROGRAMMES

the course contributes		**2) Identify basic geological processes and geological materials, and connect them with the development of life on Earth and Earth itself.** **3) Identify simple geological problems and suggest possible solutions.** **4) Recognise the role of geology in knowledge development, valuation of goods, spatial arrangement, improvement of life quality and environmental preservation.** **5) Communicate and discuss ideas and solutions of geological problems with colleagues and experts.**
2.4. Expected learning outcomes at the level of the course (3-10 learning outcomes)	Develop critical thinking, reasoning based on data, understand processes in nature, connect the knowledge of individual disciplines in the understanding of sedimentary rocks.	**1) Repeat and recognize the meaning and importance of oceanic and marine environments in geology** **2) Recognize and differentiate the depositional environments in the sea** **3) Relate the formation of sediments in the sea and their characteristics with analogous rocks on continents** **4) Integrate parts of physical, biological and chemical oceanography into a complex entity from the aspect of sediment formation in the sea environment** **5) Assess and determine the importance of ocean spaces and sediments in various current environmental problems due to climate change**
2.5. Course content (syllabus)	1) History of research in marine geology 2) Morphology and the origin of the ocean 3) Sedimentation and marine sediments 4) Seawater and hydrogenous sediments 5) Elements of physical oceanography crucial for the origin and distribution of sediments in ocean (waves, currents, tides) 6) Coasts, sea-level and their changes 7) Reflection of climate changes on sediments and sedimentation in the ocean 8) Organisms and seabed 9) Sediments in estuaries and estuarine systems 10) Residence time concept for substances in the ocean 11) Deep-sea sediments 12) Palaeoceanography 13) Mediterranean and Adriatic Sea	1) **Course introduction** and History of research in marine geology **2) Morphology and the origin of the ocean (a)** **3) Morphology and the origin of the ocean (b)** **4) Seawater – origin concepts and composition changes** **5) Biogenous and terrigenous sediments and sedimentation in the ocean** **6) Hidrogenous and cosmogenous sediments and sedimentation in the ocean** **7) Seawater movements and their influence on erosion, transport and sedimentation in the ocean** 8) Coasts, sea-level and their changes 9) Climate changes and their reflection on sediments and sedimentation in the ocean (a) **10) Climate changes and their reflection on sediments and sedimentation in the ocean (b)**

DESCRIPTION OF AMENDMENTS AND MODIFICATIONS TO UNDERGRADUATE, GRADUATE AND INTEGRATED UNDERGRADUATE AND GRADUATE STUDY PROGRAMMES

<table>
<tr><td></td><td colspan="9">14) Fundamentals of the seabed geological mapping
15) Sampling and work at the sea</td><td colspan="9">11) Organisms and ocean
12) Life on the seabed
13) Palaeoceanography
14) Basics of seabed geological mapping
15) Sampling and work at the sea</td></tr>
<tr><td>2.6. Format of instruction:</td><td colspan="5">☒ lectures
☐ seminars and workshops
☒ exercises
☐ online in entirety
☐ partial e-learning
☐ field work</td><td colspan="4">☐ independent assignments
☒ multimedia and the internet
☐ laboratory
☐ work with mentor
☐ (other)</td><td colspan="5">☒ lectures
☐ seminars and workshops
☒ exercises
☐ online in entirety
☐ partial e-learning
☐ field work</td><td colspan="4">☐ independent assignments
☐ multimedia and the internet
☒ laboratory
☐ work with mentor
☐ (other)</td></tr>
<tr><td>2.7. Comments:</td><td colspan="9"></td><td colspan="9">A change of the course status from elective to mandatory is requested, as well as reduction of exercise hours from 30 to 15.</td></tr>
<tr><td>2.8. Student obligations</td><td colspan="9">Regular classes attendance, active participation in lectures and exercises: creation of individual assignments.</td><td colspan="9">Regular classes attendance, solving assigned written and laboratory tasks, active participation in discussions on current topics in the field of marine geology.</td></tr>
<tr><td>2.9. Monitoring student work</td><td colspan="9">
<table>
<tr><td>Class attendance</td><td>YES</td><td></td><td>Research</td><td></td><td>NO</td><td>Oral exam</td><td>YES</td><td></td></tr>
<tr><td>Experimental work</td><td></td><td>NO</td><td>Report</td><td></td><td>NO</td><td>(other)</td><td></td><td>NO</td></tr>
<tr><td>Essay</td><td></td><td>NO</td><td>Seminar paper</td><td></td><td>NO</td><td>(other)</td><td></td><td>NO</td></tr>
<tr><td>Preliminary exam</td><td>YES</td><td></td><td>Practical work</td><td></td><td>NO</td><td>(other)</td><td></td><td>NO</td></tr>
<tr><td>Project</td><td></td><td>NO</td><td>Written exam</td><td>YES</td><td></td><td>ECTS (total)</td><td colspan="2">4</td></tr>
</table>
</td><td colspan="9">
<table>
<tr><td>Class attendance</td><td>YES</td><td></td><td>Research</td><td></td><td>NO</td><td>Oral exam</td><td>YES</td><td></td></tr>
<tr><td>Experimental work</td><td></td><td>NO</td><td>Report</td><td></td><td>NO</td><td>(other)</td><td></td><td>NO</td></tr>
<tr><td>Essay</td><td></td><td>NO</td><td>Seminar paper</td><td>YES</td><td></td><td>(other)</td><td></td><td>NO</td></tr>
<tr><td>Preliminary exam</td><td>YES</td><td></td><td>Practical work</td><td>YES</td><td></td><td>(other)</td><td></td><td>NO</td></tr>
<tr><td>Project</td><td></td><td>NO</td><td>Written exam</td><td>YES</td><td></td><td>ECTS (total)</td><td colspan="2">4</td></tr>
</table>
</td></tr>
<tr><td>2.10. Required literature (available in the library and/or via other media)</td><td colspan="3">Title</td><td colspan="2">Number of copies in the library</td><td colspan="2">Availability via other media</td><td colspan="3">Title</td><td colspan="2">Number of copies in the library</td><td colspan="2">Availability via other media</td></tr>
<tr><td></td><td colspan="3">Juračić, M.: Geologija mora – nastavni materijali</td><td colspan="2">NO</td><td colspan="2">YES</td><td colspan="3">Seibold, E., Berger, W. (2017): The Sea Floor – An Introduction to Marine Geology, Springer Verlag, Berlin</td><td colspan="2">YES</td><td colspan="2">YES</td></tr>
<tr><td></td><td colspan="3">Seibold, E., Berger, W. (1996): The Sea Floor – An</td><td colspan="2">YES</td><td colspan="2">NO</td><td colspan="3"></td><td colspan="2"></td><td colspan="2"></td></tr>
</table>

DESCRIPTION OF AMENDMENTS AND MODIFICATIONS TO UNDERGRADUATE, GRADUATE AND INTEGRATED UNDERGRADUATE AND GRADUATE STUDY PROGRAMMES

	Introduction to Marine Geology, Springer Verlag, Berlin					
2.11. Optional literature	Open University Course Team, Butterworth-Heinemann, Oxford, 2002.: *The Ocean Basins: Their Structure and Evolution* *Seawater: Its composition, Properties and Behaviour* *Waves, Tides and Shallow Water Processes* *Ocean Chemistry and Deep Sea Sediments* *Ocean Circulation* *Biological Oceanography – An Introduction*			Open University Course Team, Butterworth-Heinemann, Oxford, 2002.: *The Ocean Basins: Their Structure and Evolution* *Seawater: Its composition, Properties and Behaviour* *Waves, Tides and Shallow Water Processes* *Ocean Chemistry and Deep Sea Sediments* *Ocean Circulation* *Biological Oceanography – An Introduction*		

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Table 2A Description of new course – Basics of Scientific Work

1. COURSE DECRIPTION – GENERAL INFORMATION			
1.1. Course teacher	Assistant Professor Karmen Fio Firi, PhD	1.6. Year of the study	2nd and 3rd
1.2. Name of the course	Basics of Scientific Work	1.7. ECTS credits	3
1.3. Associate teachers		1.8. Type of instruction (number of hours L + S + E + e-learning)	15 + 15 + 15 + 0
1.4. Study programme (undergraduate, graduate, integrated)	Undergraduate	1.9. Expected enrolment in the course	20 – 30
1.5. Status of the course	Elective	1.10. Level of application of e-learning (level 1, 2, 3), percentage of online instruction (max. 20%)	Level 1, up to 3 %
2. COURSE DESCRIPTION			
2.1. Course objectives	Getting to know the development of science and basic terms related to science and work in science. Database search. Knowledge of proper writing related to structure, quoting, writing, but also correcting and presenting papers. Getting to know scientific institutions and their role, as well as different projects and programs. Writing and presenting a CV.		
2.2. Enrolment requirements and/or entry competences required for the course			
2.3. Learning outcomes at the level of the programme to which the course contributes	1) Apply information technologies (IT) when processing and presenting data. 2) Use geological maps, domestic and foreign literature and databases, as well as other sources of information. 3) Plan further professional development on the basis of acquired geological knowledge and developed specific skills.		
2.4. Expected learning outcomes at the level of the course (3-10 learning outcomes)	1) State what science and scientific research are. Describe the historical development of science and famous scientists and the hierarchy in science. 2) Display and apply information from different databases. 3) Distinguish and use different types of scientific publications and bibliographies. 4) Use the structure of the paper/article and the rules for writing literature and publishing scientific papers. 5) Apply the acquired writing rules and evaluate and evaluate works. 6) Present your own research and describe other people's works, prepare a project proposal. 7) Distinguish between science and pseudoscience and recognize misuse of science. 8) Prepare your own resume and supporting documentation.		
2.5. Course content (syllabus)	1) Introduction about science, historical development of science; important scientists throughout history, important geologists and their fields of research. 2) Characteristics of scientific work, types of scientific work; hypothesis and theory; research methodology; scientific institutions in Croatia; investment in science.		

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	3) Scientific publications, publishers; Journal quality indicators; Databases and their search; The importance of scientists according to published works. 4) Types of scientific publications. Citation of works. 5) Ways of labelling publications. Collections, archives and catalogues. 6) Scientific projects and programs. Methods of short presentation of data. 7) Work structure – writing articles. Ways of citing works. 8) Types of assessment papers. The way of writing assessment papers. 9) Text editing. 10) Review and correction of works. 11) Presentation at gatherings, oral presentations and posters. 12) Scientific career and employment in science. Law on scientific activity and higher education. Abuse of science. 13) Writing a resume.

2.6. Format of instruction:	☒ lectures ☒ seminars and workshops ☒ exercises ☐ online in entirety ☐ partial e-learning ☐ field work	☒ independent assignments ☐ multimedia and the internet ☐ laboratory ☐ work with mentor ☐ (other)	2.7. Comments:

2.8. Student obligations									
2.9. Monitoring student work	Class attendance	YES		Research		NO	Oral exam	YES	
	Experimental work		NO	Report		NO	(other)	YES	NO
	Essay		NO	Seminar paper	YES		(other)	YES	NO
	Preliminary exam	YES		Practical work		NO	(other)	YES	NO
	Project		NO	Written exam	YES		ECTS (total)	3	

	Title	**Number of copies in the library**	**Availability via other media**
2.10. Required literature (available in the library and/or via other media)	Boyle, J., Ramsay, S. (2017): *Writing for Science Students,* Palgrave, London, 206 p	YES	NO
	Gačić, M. (2017): *Pisanje u znanosti i struci,* Narodne novine, Zagreb, 233 p	YES	NO
	Silobrčić. V. (1998): *Kako sastaviti, objaviti i ocijeniti znanstveno djelo,* Medicinska naklada, Zagreb, 168 p	YES	NO
2.11. Optional literature (name the title)	Cochran, W., Fenner, P., Hill, M. (ur.) (1979): *Geowriting – a guide to writing, editing, and printing in earth science*, American Geological Institute, Falls Church, 80 p Zelenika, R. (1998): *Metodologija i tehnologija izrade znanstvenog i stručnog dijela,* Ekonomski fakultet Sveučilišta u Rijeci, Rijeka, 782 p		

DESCRIPTION OF AMENDMENTS AND MODIFICATIONS TO UNDERGRADUATE, GRADUATE AND INTEGRATED UNDERGRADUATE AND GRADUATE STUDY PROGRAMMES

Table 2B Description of the course that was amended and/or modified – Methods in Paleontology

1. COURSE DECRIPTION – GENERAL INFORMATION		
	Before the modification	**After the modification**
1.1. Course teacher	Full Professor in tenure Vlasta Ćosović, PhD	**Associate Professor Đurđica Pezelj, PhD**
1.2. Name of the course	Methods in Paleontology	Methods in Paleontology
1.3. Associate teachers		
1.4. Study programme (undergraduate, graduate, integrated)	Undergraduate	Undergraduate
1.5. Status of the course	Elective	Elective
1.6. Year of the study	3rd	3rd
1.7. ECTS credits	4	**3**
1.8. Type of instruction (number of hours L + E + S + e-learning)	15 + 30 + 0 + 0	15 + 30 + 0 + 0
1.9. Expected enrolment in the course	5 – 10	5 – 10
1.10. Level of application of e-learning (level 1, 2, 3), percentage of online instruction (max. 20%)	Level 1, up to 3%	Level 1, up to 3%
2.1. Course objectives	Students will gain a comprehensive understanding of sampling techniques, laboratory techniques, and the application of fossils in biostratigraphy, paleoecology (including paleoceanography), and in the evolution of life on Earth.	Students will gain a comprehensive understanding of sampling techniques, laboratory processing of rock-samples to obtain fossils, will learn how to apply selected fossil groups in the detailed interpretation of past environments and reconstruction of past biota, and in biostratigraphy.
2.2. Course enrolment requirements and/or entry competences required for the course	Passed exams: General Paleontology, Historical Geology I and Historical Geology II.	**Passed the General Paleontology exam.**
2.3. Learning outcomes at the level of the programme to which	To minimise inaccuracies and assumptions in the final interpretation, it is crucial to gain a comprehensive understanding of full paleontological significance of microfossils and macrofossils.	**1) Recognise and apply basic and specific knowledge related to the fundamental laws of natural science in the interpretation of geological processes.**

DESCRIPTION OF AMENDMENTS AND MODIFICATIONS TO UNDERGRADUATE, GRADUATE AND INTEGRATED UNDERGRADUATE AND GRADUATE STUDY PROGRAMMES

the course contributes		**2) Identify basic geological processes and geological materials and connect them with the development of life on Earth and Earth itself.** **3) Identify simple geological problems and suggest possible solutions.** **4) Select and use suitable geological methods and specific technologies in solving geological problems.** **9) Independently analyse geological samples in the laboratory, write and present results of research.** **10) Identify problems related to sampling and data processing in field and laboratory research.** **11) Organise field and laboratory data and compare them with acquired professional knowledge.** **12) Communicate and discuss ideas and solutions of geological problems with colleagues and experts.**
2.4. Expected learning outcomes at the level of the course (3-10 learning outcomes)	The accurate interpretation of fossils requires a rigorous approach that encompasses the proper sampling techniques, meticulous laboratory preparation, systematic fossil identification, and comprehensive paleoecological, biostratigraphic and evolutional analyses.	**1) Describe and recognize methods of laboratory processing of samples with micro- and macrofossils.** **2) Apply basic research methods in paleontology.** **3) Interpret simple phylogenetic reconstructions and their application.** **4) Describe and demonstrate the interpretation of past environments using the composition of microfossil assemblages.** **5) Be able to apply analytical methods to analyse the basic concept of paleoecology and paleoclimatology.** **6) Comprehend a range of dating methods used in paleontology.**
2.5. Course content (syllabus)	1. Fossils, where do you find them? 2. Sampling techniques (surface and subsurface). 3-4. Processing of microfossils in the laboratory 5. Laboratory processing of vertebrate remains 6. Laboratory processing of macrofossils of invertebrates 7. Systematics in paleontology (Exercise: synonymy in taxonomy of selected foraminifera species) 8. Systematics II (Exercise: Identification of species using the example of benthic foraminifera)	1) Fossils, where do you find them? **Sampling techniques (surface and subsurface).** 2) Laboratory processing of microfossils 3) Laboratory processing of vertebrate remains. 4) **Laboratory processing of plant remains** and macrofossils of invertebrates. 5) Systematics in paleontology (Exercise: synonymy in taxonomy, **identification keys for species larger benthic foraminifera**).

DESCRIPTION OF AMENDMENTS AND MODIFICATIONS TO UNDERGRADUATE, GRADUATE AND INTEGRATED UNDERGRADUATE AND GRADUATE STUDY PROGRAMMES

<table>
<tr><td></td><td colspan="2">9. Classification, numerical taxonomy, and cladistics (Exercise: creation of phenograms and cladograms; calculation of the similarity coefficient).
10. Biostratigraphy, biostratigraphic sampling, frequency, precision (Exercise: correlation of geological columns based on index fossils; quantitative biostratigraphy).
11. Biostatistics, biodiversity indices (Exercise: use of the Past program, calculation of indices, creating the dendrograms).
12. Functional morphology (Exercise: testing Raup's theoretical model; structural analysis of the foraminifera tests).
13. Paleoecological interpretation (Exercise: Interpret the paleoenvironment based on the selected foraminifera assemblages)
14-15. Preparation of an independent paper on the selected sample</td><td colspan="2">6) Classification: Numerical taxonomy and cladistics (Exercise: creation of phenograms and cladograms; calculation of the similarity coefficient).
7) Biostratigraphy, biostratigraphic sampling: frequency, precision (Exercise: correlation of geological columns based on index fossils; quantitative biostratigraphy).
8) Biostatistics, assemblage (sinecology) paleoecology, biodiversity indices (Exercise: use of the Past program, calculation of indices, drawing of dendrograms).
9) Functional morphology (Exercise: testing Raup's theoretical model; evaluation of forms and functions in foraminifera and/or ammonites).
10) Paleoecological interpretation (Exercise: Interpret abiotic parameters of the environment based on the selected foraminifera assemblage)
11) Stable isotopes and geochemical data, from sample preparation to interpretation (Exercises: graphical and descriptive interpretation of data)
12) Paleoclimatology (Exercise: application of analogue methods)
13) Principles of ichnology (Exercise: application of formulas to calculate morphological characteristics of organisms based on the traces).
14-15) Preparation of independent work on one sedimentary sample with microfossils.</td></tr>
<tr><td>2.6. Format of instruction:</td><td>☒ lectures
☐ seminars and workshops
☒ exercises
☐ online in entirety
☐ partial e-learning
☐ field work</td><td>☒ independent assignments
☒ multimedia and the internet
☒ laboratory
☐ work with mentor
☐ (other)</td><td>☒ lectures
☒ seminars and workshops
☒ exercises
☐ online in entirety
☐ partial e-learning
☐ field work</td><td>☒ independent assignments
☒ multimedia and the internet
☐ laboratory
☐ work with mentor
☐ (other)</td></tr>
<tr><td>2.7. Comments:</td><td colspan="2"></td><td colspan="2">A decrease in ECTS points from 4 to 3 is requested, because the previous number of ECTS points did not correspond to the point value of the course.</td></tr>
<tr><td>2.8. Student obligations</td><td colspan="2"></td><td colspan="2">Attending classes and passing colloquia.</td></tr>
</table>

DESCRIPTION OF AMENDMENTS AND MODIFICATIONS TO UNDERGRADUATE, GRADUATE AND INTEGRATED UNDERGRADUATE AND GRADUATE STUDY PROGRAMMES

2.9. Monitoring student work	Class attendance	YES		Research		NO	Oral exam	YES		Class attendance	YES		Research	**YES**		Oral exam	YES	
	Experimental work	YES		Report		NO	(other)		NO	Experimental work	YES		Report	**YES**		(other)		NO
	Essay	YES		Seminar paper		NO	(other)		NO	Essay	YES		Seminar paper		NO	(other)		NO
	Preliminary exam	YES		Practical work	YES		(other)		NO	Preliminary exam	YES		Practical work	YES		(other)		NO
	Project		NO	Written exam	YES		ECTS (total)	4		Project		NO	Written exam	YES		ECTS (total)	**3**	

	Title	**Number of copies in the library**	**Availability via other media**	**Title**	**Number of copies in the library**	**Availability via other media**
2.10. Required literature (available in the library and/or via other media)	Amstrong, H., Brasier, M. (2005): *Microfossils,* Blackwell Publishing, 296 p.	YES	NO	**Green, O.R. (2001): *A manual of practical laboratory and field techniques in paleobiology,* Springer Dordrecht**	**YES**	**YES**
	Monk et al. (ed), (2007): *Environmental sampling, Guideline for Archaeologist*, 56 p.	NO	YES	**Saraswati, P.K., Srinivasan, M.S. (2016): *Micropaleontology, Principles and Applications,* Springer Publications**	**YES**	**YES**
	Cifelli, R.L. (ed), (1996): *Technoque for recovery and preparation of Microvertebrate fossils*; Oklahoma Geological Survey, 41 p.	NO	YES	**Hammer, O., Harper, D.A.T., Ryan, P.D. (2001): *Past: Paleontological statistics software package for education and dana analysis,* Paleontologia Electronica 4**	**NO**	**YES**
2.11. Optional literature				Cifelli, R.L. (ed.) (1996): *Technoque for recovery and preparation of Microvertebrate fossils,* Oklahoma Geological Survey, 41 p.		

DESCRIPTION OF AMENDMENTS AND MODIFICATIONS TO UNDERGRADUATE, GRADUATE AND INTEGRATED UNDERGRADUATE AND GRADUATE STUDY PROGRAMMES

Table 2A Description of the new course – Environmental Geochemistry

1. COURSE DECRIPTION – GENERAL INFORMATION			
1.1. Course teacher	Associate Professor Hana Fajković, PhD	1.6. Year of the study	3rd
1.2. Name of the course	Environmental Geochemistry	1.7. ECTS credits	3
1.3. Associate teachers		1.8. Type of instruction (number of hours L + S + E + e-learning)	30 + 15 + 0 + 0
1.4. Study programme (undergraduate, graduate, integrated)	Undergraduate	1.9. Expected enrolment in the course	20
1.5. Status of the course	Elective	1.10. Level of application of e-learning (level 1, 2, 3), percentage of online instruction (max. 20%)	1
2. COURSE DESCRIPTION			
2.1. Course objectives	Connecting geochemical processes with processes in the environment, and with significance for people and the living world, and for all components of the environment.		
2.2. Enrolment requirements and/or entry competences required for the course	Passed course Geochemistry.		
2.3. Learning outcomes at the level of the programme to which the course contributes	1) Identify simple geological problems and suggest possible solutions. 2) Select and use suitable geological methods and specific technologies in solving geological problems. 3) Perform relevant experiments and analyses independently or in a group and present data using suitable qualitative and quantitative methods. 4) Identify problems related to sampling and data processing in field and laboratory research. 5) Communicate and discuss ideas and solutions of geological problems with colleagues and experts.		
2.4. Expected learning outcomes at the level of the course (3-10 learning outcomes)	1) Application of natural scientific laws in the interpretation of processes on Earth. 2) The possibility of choosing the appropriate analytical method depending on the given problem. 3) Interpretation and systematization of the results, with a conclusion on the investigated problem. 4) Searching and using literature.		
2.5. Course content (syllabus)	1) Introduction and legislation related to environmental geochemistry 2) Feedbacks and systems in environmental geochemistry 3–4) Biogeochemical cycles (carbon, sulphur, phosphorus, nitrogen) 5) The concept of global warming 6) Acid rain and its effect on geological materials 7) Geochemical concept of carbonate terrain pollution 8) Chemical time bomb; definition, concept explanation, chemical time bomb prediction. 9–10) Chemical weathering 11–12) Sedimentation rate of Cs and Pb		

DESCRIPTION OF AMENDMENTS AND MODIFICATIONS TO UNDERGRADUATE, GRADUATE AND INTEGRATED UNDERGRADUATE AND GRADUATE STUDY PROGRAMMES

	13) Normalization and enrichment factor in environmental geochemistry 14) Geomedicine (medical geochemistry)		
2.6. Format of instruction:	☒ lectures ☐ seminars and workshops ☒ exercises ☐ online in entirety ☐ partial e-learning ☐ field work	☒ independent assignments ☐ multimedia and the internet ☐ laboratory ☐ work with mentor ☐ (other)	2.7. Comments:
2.8. Student obligations	Active attendance of classes, along with solving tasks and discussion. Preparation for a specific problem task.		

2.9. Monitoring student work									
	Class attendance	YES		Research	YES		Oral exam	YES	
	Experimental work		NO	Report		NO	(other)		
	Essay		NO	Seminar paper		NO	(other)		
	Preliminary exam	YES		Practical work		NO	(other)		
	Project		NO	Written exam	YES		ECTS (total)	3	

2.10. Required literature (available in the library and/or via other media)	**Title**	**Number of copies in the library**	**Availability via other media**
	Prohić, E. (1998): *Geokemija*, Targa, 554 p	YES	NO

2.11. Optional literature (name the title)	
	Gill, R. (2015): *Chemical Fundamentals of Geology and Environmental Geoscience*, Wiley-Blackwell, 288 p Misra, K.C. (2012): *Introduction to Geochemistry: Principles and Applications*, Wiley-Blackwell, Chichester, UK 452 p

DESCRIPTION OF AMENDMENTS AND MODIFICATIONS TO UNDERGRADUATE, GRADUATE AND INTEGRATED UNDERGRADUATE AND GRADUATE STUDY PROGRAMMES

Table 2A Description of the new course – Mineral Raw Materials

1. COURSE DECRIPTION – GENERAL INFORMATION			
1.1. Course teacher	Full Professor Nenad Tomašić, PhD; Assistant Professor Andrea Čobić, PhD	1.6. Year of the study	3rd
1.2. Name of the course	Mineral Raw Materials	1.7. ECTS credits	3
1.3. Associate teachers		1.8. Type of instruction (number of hours L + S + E + e-learning)	30 + 15 + 0 + 0
1.4. Study programme (undergraduate, graduate, integrated)	Undergraduate	1.9. Expected enrolment in the course	5
1.5. Status of the course	Elective	1.10. Level of application of e-learning (level 1, 2, 3), percentage of online instruction (max. 20%)	Level 1
2. COURSE DESCRIPTION			
2.1. Course objectives	Get to know most important non-metallic and metallic mineral raw materials which are used in recovery of metals and non-metals, as well as their compounds necessary for industry and technology development. Get to know basic raw materials for construction uses and the most significant gems. To raise awareness of raw materials' significance in functioning and development of the modern world.		
2.2. Enrolment requirements and/or entry competences required for the course	Passed General Mineralogy and System of Mineralogy.		
2.3. Learning outcomes at the level of the programme to which the course contributes	1) To identify basic geological processes and geological materials, and connect them with the development of life on Earth and Earth itself. 2) To use geological maps, domestic and foreign literature and databases, as well as other sources of information. 3) To recognise the role of geology in knowledge development, valuation of goods, spatial arrangement, improvement of life quality and environmental preservation.		
2.4. Expected learning outcomes at the level of the course (3-10 learning outcomes)	1) To identify the most significant mineral raw materials for critical metals and non-metals. 2) To identify principal raw materials for certain metals and non-metals. 3) To distinguish minerals and mineral raw materials. 4) To compare advantages and disadvantages of certain raw materials in selected metal and non-metal recovery. 5) To connect certain mineral raw materials occurrence in specific mineral association and geological environments. 6) To categorize metallic and non-metallic raw materials. 7) To predict geological environments in which it would be possible to locate certain raw materials. 8) To assess significance of certain mineral raw materials in specific industry of modern world.		
2.5. Course content (syllabus)	1) Mineral raw materials – basic definitions, relation to other geological disciplines and industries; division and mode of occurrence of mineral raw materials; basic methods in mineral raw materials recovery. 2) Metallic mineral raw materials I: Precious metals (Au, Ag, Pt, PD, Ir, Os)		

DESCRIPTION OF AMENDMENTS AND MODIFICATIONS TO UNDERGRADUATE, GRADUATE AND INTEGRATED UNDERGRADUATE AND GRADUATE STUDY PROGRAMMES

	3) Metallic mineral raw materials II: Fe, Ni, Cr, Co, Mn 4) Metallic mineral raw materials III: Pb, Zn, Cu, Sn, Bi 5) Metallic mineral raw materials IV: Ti, Nb, Ta, W, Mo 6) Metallic mineral raw materials V: alkaline and alkaline earths elements 7) Metallic mineral raw materials VI: Al, Ga, In, Tl, V 8) Metallic mineral raw materials VII: rare earth elements 9) Metallic mineral raw materials VIII: U, Th, Zr, Hf 10) Metalloid mineral raw materials: B, Si, Ge, As, Sb 11) Non-metallic mineral raw materials I: C, S, N, P, Se 12) Non-metallic mineral raw materials II: halogens 13) Mineral aggregates: gravel, effusives, clays, dolomite (in Croatia) 14) Mineral raw materials in concrete production 15) Gemstones

2.6. Format of instruction:	☒ lectures ☐ seminars and workshops ☒ exercises ☐ online in entirety ☐ partial e-learning ☐ field work	☐ independent assignments ☐ multimedia and the internet ☐ laboratory ☐ work with mentor ☐ (other)	2.7. Comments:
2.8. Student obligations	Attending classes.		

2.9. Monitoring student work									
	Class attendance	YES		Research		NO	Oral exam		NO
	Experimental work		NO	Report	YES		(other)	YES	NO
	Essay		NO	Seminar paper		NO	(other)	YES	NO
	Preliminary exam		NO	Practical work		NO	(other)	YES	NO
	Project		NO	Written exam	YES		ECTS (total)	3	

2.10. Required literature (available in the library and/or via other media)	**Title**	**Number of copies in the library**	**Availability via other media**
	Klein, C. (2002): *Mineral Science*, John Wiley ¸Sons, Inc., New York.	YES	NO
	Chang, L.L.Y. (2002): *Industrial Mineralogy*, Prentice Hall, New Yersey.	YES	NO

2.11. Optional literature (name the title)	Bermanec, V. (1999): *System of mineralogy – mineralogy of non-silicate minerals*. Targa, Zagreb, 264 pp.

DESCRIPTION OF AMENDMENTS AND MODIFICATIONS TO UNDERGRADUATE, GRADUATE AND INTEGRATED UNDERGRADUATE AND GRADUATE STUDY PROGRAMMES

	Slovenec, D., Bermanec V. (2004): *System of mineralogy – mineralogy of silicate minerals*. Denona, Zagreb, 359 pp. Evans, A.M. (1993): *Ore Geology and Industrial Minerals An Introduction*, Blackwell Science, London

DESCRIPTION OF AMENDMENTS AND MODIFICATIONS TO UNDERGRADUATE, GRADUATE AND INTEGRATED UNDERGRADUATE AND GRADUATE STUDY PROGRAMMES

Table 2B Description of the course that was amended and/or modified – Internship

1. COURSE DECRIPTION – GENERAL INFORMATION		
	Before the modification	**After the modification**
1.1. Course teacher	Associate Professor Hana Fajković, PhD Assistant Professor Karmen Fio Firi, PhD	Associate Professor Hana Fajković, PhD Assistant Professor Karmen Fio Firi, PhD
1.2. Name of the course	Internship	Internship
1.3. Associate teachers		
1.4. Study programme (undergraduate, graduate, integrated)	Undergraduate	Undergraduate
1.5. Status of the course	Elective outside the compulsory core	Elective outside the compulsory core
1.6. Year of the study	3rd	3rd
1.7. ECTS credits	4	4
1.8. Type of instruction (number of hours L + E + S + e-learning)	0 + 90 + 0 + 0	0 + 90 + 0 + 0
1.9. Expected enrolment in the course	10	10
1.10. Level of application of e-learning (level 1, 2, 3), percentage of online instruction (max. 20%)	Level 1, 5%	Level 1, 5 %
2.1. Course objectives	The internship course aims to connect students with potential future employers by carrying out practical work at employers with whom the Faculty of Science (PMF) of the University of Zagreb has signed a co-operation agreement. The aim of work experience is to enable students to deepen and broaden the knowledge and skills acquired through theoretical and practical education in the classical form of teaching, to familiarise them with work processes in a real working environment and to prepare them for the labour market.	The internship course aims to connect students with potential future employers by carrying out practical work at employers with whom the Faculty of Science (PMF) of the University of Zagreb has signed a co-operation agreement. The aim of work experience is to enable students to deepen and broaden the knowledge and skills acquired through theoretical and practical education in the classical form of teaching, to familiarise them with work processes in a real working environment and to prepare them for the labour market.
2.2. Course enrolment requirements and/or entry competences	There are no special requirements for enrolment in a course. The entry competences required for the subject are independence and responsibility.	There are no special requirements for enrolment in a course. The entry competences required for the subject are independence and responsibility.

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required for the course				
2.3. Learning outcomes at the level of the programme to which the course contributes	1) Basic knowledge and understanding of the natural sciences (Physics, Chemistry, Biology, Mathematics) underlying the study of Geology. 2) Knowledge and understanding of the essential features, processes, materials, history and 3) the development of the Earth and life 4) Basic ability to independently analyse earth materials in the field and laboratory and to describe, process, document and report the results 5) Basic knowledge of the application of information technology to geological science (geochemistry, ore deposits, sedimentation basins, hydrogeology, engineering geology and computer applications applicable in the geological profession)		1) Basic knowledge and understanding of the natural sciences (Physics, Chemistry, Biology, Mathematics) underlying the study of Geology. 2) Knowledge and understanding of the essential features, processes, materials, history and 3) the development of the Earth and life 4) Basic ability to independently analyse earth materials in the field and laboratory and to describe, process, document and report the results 5) Basic knowledge of the application of information technology to geological science (geochemistry, ore deposits, sedimentation basins, hydrogeology, engineering geology and computer applications applicable in the geological profession)	
2.4. Expected learning outcomes at the level of the course (3-10 learning outcomes)	1) Describe business processes, methods and working conditions in the working environment. 2) Independently plan and carry out a simple work task. 3) Process and interpret qualitative and quantitative data. 4) Apply basic IT skills and tools. 5) Choose an appropriate way to communicate with different stakeholders (e.g. professional and lay audiences, media, investors, etc.) on professional topics. 6) Work actively as part of a team. 7) Present the results of the professional task. 8) Apply the knowledge acquired in the undergraduate programme in identifying, determining and solving problems of simple to moderate complexity.		1) Describe business processes, methods and working conditions in the working environment. 2) Independently plan and carry out a simple work task. 3) Process and interpret qualitative and quantitative data. 4) Apply basic IT skills and tools. 5) Choose an appropriate way to communicate with different stakeholders (e.g. professional and lay audiences, media, investors, etc.) on professional topics. 6) Work actively as part of a team. 7) Present the results of the professional task. 8) Apply the knowledge acquired in the undergraduate programme in identifying, determining and solving problems of simple to moderate complexity.	
2.5. Course content (syllabus)	Students will go to selected institutions where they undertake a series of tasks set by the mentor, for a total duration of 90 hours/ year.		Students will go to selected institutions where they undertake a series of tasks set by the mentor, for a total duration of 90 hours/ year.	
2.6. Format of instruction:	☐ lectures ☐ seminars and workshops ☐ exercises ☐ online in entirety ☐ partial e-learning	☒ independent assignments ☐ multimedia and the internet ☐ laboratory	☐ lectures ☐ seminars and workshops ☐ exercises ☐ online in entirety ☐ partial e-learning	☒ independent assignments ☐ multimedia and the internet ☐ laboratory

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<table>
<tr><td></td><td colspan="4">☐ field work</td><td colspan="5">☒ work with mentor
☐ (other)</td><td colspan="4">☐ field work</td><td colspan="5">☒ work with mentor
☐ (other)</td></tr>
<tr><td>2.7. Comments:</td><td colspan="9">The Faculty of Science must first sign a cooperation agreement with the institution where the internship will be carried out.</td><td colspan="9">The Faculty of Science must first sign a cooperation agreement with the institution where the internship will be carried out.</td></tr>
<tr><td>2.8. Student obligations</td><td colspan="9">Complete 90 hours of practise with the employer and complete a report and survey upon completion.</td><td colspan="9">Complete 90 hours of practise with the employer and complete a report and survey upon completion.</td></tr>
<tr><td rowspan="5">2.9. Monitoring student work</td><td>Class attendance</td><td></td><td>NO</td><td>Research</td><td></td><td>NO</td><td>Oral exam</td><td></td><td>NO</td><td>Class attendance</td><td></td><td>NO</td><td>Research</td><td></td><td>NO</td><td>Oral exam</td><td></td><td>NO</td></tr>
<tr><td>Experimental work</td><td></td><td>NO</td><td>Report</td><td></td><td>NO</td><td>Employer/mentor report</td><td>YES</td><td></td><td>Experimental work</td><td></td><td>NO</td><td>Report</td><td></td><td>NO</td><td>Employer/ mentor report</td><td>YES</td><td></td></tr>
<tr><td>Essay</td><td></td><td>NO</td><td>Seminar paper</td><td></td><td>NO</td><td>Student report</td><td>YES</td><td></td><td>Essay</td><td></td><td>NO</td><td>Seminar paper</td><td></td><td>NO</td><td>Student report</td><td>YES</td><td></td></tr>
<tr><td>Preliminary exam</td><td></td><td>NO</td><td>Practical work</td><td>YES</td><td></td><td>(other)</td><td></td><td>NO</td><td>Preliminary exam</td><td></td><td>NO</td><td>Practical work</td><td>YES</td><td></td><td>(other)</td><td></td><td>NO</td></tr>
<tr><td>Project</td><td></td><td>NO</td><td>Written exam</td><td></td><td>NO</td><td>ECTS (total)</td><td colspan="2">4</td><td>Project</td><td></td><td>NO</td><td>Written exam</td><td></td><td>NO</td><td>ECTS (total)</td><td colspan="2">4</td></tr>
<tr><td rowspan="7">2.10. Required literature (available in the library and/or via other media)</td><td colspan="4">Title</td><td colspan="2">Number of copies in the library</td><td colspan="3">Availability via other media</td><td colspan="4">Title</td><td colspan="3">Number of copies in the library</td><td colspan="2">Availability via other media</td></tr>
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<tr><td colspan="4"></td><td colspan="2"></td><td colspan="3"></td><td colspan="4"></td><td colspan="3"></td><td colspan="2"></td></tr>
<tr><td>2.11. Optional literature</td><td colspan="9"></td><td colspan="9"></td></tr>
</table>

DESCRIPTION OF AMENDMENTS AND MODIFICATIONS TO UNDERGRADUATE, GRADUATE AND INTEGRATED UNDERGRADUATE AND GRADUATE STUDY PROGRAMMES

Table 2B Description of the course that was amended and/or modified – Geology of Mineral Deposits

1. COURSE DECRIPTION – GENERAL INFORMATION		
	Before the modification	**After the modification**
1.1. Course teacher	Assistant Professor Andrea Čobić, PhD	Assistant Professor Andrea Čobić, PhD, **Full Professor with tenure Dražen Balen, PhD**
1.2. Name of the course	Geology of Mineral Deposits	Geology of Mineral Deposits
1.3. Associate teachers		**Laura Posarić, Mag. Ing. Geol.** **Petra Schneider, PhD**
1.4. Study programme (undergraduate, graduate, integrated)	Undergraduate	Undergraduate
1.5. Status of the course	Mandatory	Mandatory
1.6. Year of the study	3rd	3rd
1.7. ECTS credits	5	5
1.8. Type of instruction (number of hours L + E + S + e-learning)	45 + 15 + 0 + 0	45 + 15 + 0 + 0
1.9. Expected enrolment in the course	25	25
1.10. Level of application of e-learning (level 1, 2, 3), percentage of online instruction (max. 20%)	Level 1, 0 %	Level 1, 0 %
2.1. Course objectives	The course is provided to get a student acquainted with geological and geochemical processes responsible for formation of mineral deposits. Ore petrology and metallogeny is also an essential element in reconstruction of Dinarides evolution.	**Get acquainted with igneous, magmatic-hydrothermal and hydrothermal processes in mineral deposits' genesis. Get acquainted with basic types of igneous, magmatic-hydrothermal, hydrothermal and sedimentary/weathering processes, and methods of mineral deposit' analyses. Connect and anticipate genesis of a specific deposit in a global plate tectonic cycle phase. Connect genesis of a specific mineral deposit type in Dinarides with plate tectonics cycle.**
2.2. Course enrolment requirements and/or entry competences	Passed courses: General Mineralogy, Igneous and Metamorphic Petrology, System of Mineralogy, completed Geochemistry.	Passed courses: General Mineralogy, **Igneous Petrology, Metamorphic Petrology,** System of Mineralogy, completed Geochemistry.

required for the course		
2.3. Learning outcomes at the level of the programme to which the course contributes	GL_1. Basic knowledge and understanding of the natural sciences (Physics, Chemistry, Biology, Mathematics) underlying the study of Geology. GL_2. Knowledge and understanding of the essential features, processes, materials, history and the development of the Earth and life. GL_3. Basic knowledge and understanding of the key aspects and concepts of geology. GL_4. Knowledge of the common terminology and nomenclature and the use of bibliography in Geosciences. GL_5. An awareness of the wider spectrum of geological disciplines. GL_6. Awareness and understanding of the temporal and spatial dimensions in Earth processes. GL_7. Awareness of the applications and responsibilities of Geology and its role in society including its environmental aspects. GL_8. Awareness of major geological paradigms, the extent of geological time and Plate Tectonics. GL_9. Knowledge and understanding of the complex nature of interactions within the geosphere. GL_10. Appropriate knowledge of other disciplines relevant to geology. GL_11. Ability to create simple geological models. GL_12. Some understanding of the complexity of geological problems and the feasibility of their solution. GL_13. Understanding the need of a rational use of earth resources. GL_15. Knowledge of appropriate solution patterns for geological problems. GL_16. Basic ability to describe a solution at an abstract level. GL_17. Knowledge of the range of applications of Geology. GL_18. Ability to integrate field and laboratory evidence with theory following the sequence from observation to recognition, synthesis and modelling.	**1) Recognise and apply basic and specific knowledge related to the fundamental laws of natural science in the interpretation of geological processes.** **2) Identify basic geological processes and geological materials, and connect them with the development of life on Earth and Earth itself.** **3) Identify simple geological problems and suggest possible solutions.** **4) Use geological maps, domestic and foreign literature and databases, as well as other sources of information.** **5) Recognise the role of geology in knowledge development, valuation of goods, spatial arrangement, improvement of life quality and environmental preservation.**

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	GL_28. Ability to receive and respond to a variety of information sources (e.g. textual, numerical, verbal, graphical).	
2.4. Expected learning outcomes at the level of the course (3-10 learning outcomes)	1) Basic knowledge strongly depends on the middle school experience (high school in USA). In average bellow some colloquially accepted standards. 2) General knowledge on materials, evolution of the Earth as a planet and the life on it, is raised in the course of the study program. 3) The basic understanding of principles is successfully acquired. Terminology, nomenclature and use of bibliography are gradually improved to the level satisfactory for undergraduate study. 4) One of the aims of the course is to emphasize interdisciplinary connections, necessary for understanding of complex ore forming processes, and contemporary problems in the environmental protection. 5) Global tectonics in explanation of metallogenic principles is widely in use.	**1) Describe and recognize basic features of mineral deposits.** **2) Explain and demonstrate knowledge on basic methods in mineral deposits analyses.** **3) Interpret mineral deposit genesis.** **4) Sketch basic geological relations of host rock and mineral deposit.** **5) Connect the appearance of a specific mineral deposit with geotectonic environment and global plate tectonics cycle.** **6) Connect specific mineral deposit in Dinarides with global plate tectonics cycle phases.**
2.5. Course content (syllabus)	1) Earth structure, origin of magma, elements of global tectonics, 2) Geology of the Dinarides, 3) Deposits related to liquid magma processes, crystallisation differentiates, liquid segregates 4) Chromite, Ni-Co sulphides (platinum), carbonatite, komatiite, diamond, nefelinite, titanomagnetite, apatite, late-magmatic (Kiruna type), 5) Postmagmatic, pegmatites, 6) Pneumatolites, (skarns, greisens), 7) Massive sulphides (Cypruss type), 8) Hydrothermal deposits (kata-, meso-epi), Cu-porphyries, (cementation zone), 9) High-sulphidation, Low-sulphidation, (Bor, Majdanpek, Trepča), 10) With loose connection to magmatism (Ljubija siderite deposit), SEDEX (Fe-Vareš, Hg-Idrija, Mn-Čevljanovići), Kuroko, Mississippi valley Pb-Zn (Mežica, Bleiberg, Olovo),	**1) Mineral deposits – basic definitions, connection to other disciplines, mineral deposits' textures. Wilson cycle.** **2) Basic methods of mineral deposits' analyses.** **3) Igneous processes in mineral deposit genesis.** **4) Igneous deposits – kimberlite, chromite, massive sulphide deposits, uranium deposits in granites. Metamorphic deposits.** **5) Magmatic-hydrothermal processes in mineral deposits' genesis.** **6) Pegmatites.** **7) Cu-Mo, Mo-Cu and Sn-W porphyry deposits. Skarns.** **8) Low- and high-sulphidation epithermal mineral deposits.** **9) Hydrothermal processes in mineral deposits' genesis.** **10) Stratabound mineral deposits.** **11) Mississippi valley, VMS and SEDEX type deposits.** **12) Carlin-type deposits.** **13) Weathering/supergene mineral deposits. Bauxites, laterites.** **14) Plate tectonics and metallogeny.**

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	11) Sedimentary deposit, Sabkha related, (Cu-schists, Ba-Lokve), resistates (Au, Pt, diamonds, cassiterite), 12) Precipitates (U-Žirovski Vrh, Colorado Plateau type), hidrolysates (bauxites, laterites, Ni-laterites), 13) Metamorphogenic and metamorphose deposits (Au-mesothermal), 14) Metallogeny and plate tectonics (Wilson Alpine cycle) in general, in Dinarides.	**15) Metallogeny of Dinarides based on plate tectonics cycle principles.**
2.6. Format of instruction:	☒ lectures ☐ seminars and workshops ☒ exercises ☐ online in entirety ☐ partial e-learning ☐ field work ☐ independent assignments ☐ multimedia and the internet ☐ laboratory ☐ work with mentor ☐ (other)	☒ lectures ☐ seminars and workshops ☒ exercises ☐ online in entirety ☐ partial e-learning ☐ field work ☐ independent assignments ☐ multimedia and the internet ☒ **laboratory** ☐ work with mentor ☐ (other)
2.7. Comments:		
2.8. Student obligations		

2.9. Monitoring student work

Class attendance	YES		Research		NO	Oral exam	YES		Class attendance	YES		Research		NO	Oral exam	YES	
Experimental work		NO	Report		NO	(other)		NO	Experimental work		NO	Report		NO	(other)		NO
Essay		NO	Seminar paper		NO	(other)		NO	Essay		NO	Seminar paper		NO	(other)		NO
Preliminary exam	YES		Practical work		NO	(other)		NO	Preliminary exam	YES		Practical work		NO	(other)		NO
Project		NO	Written exam	YES		ECTS (total)	5		Project		NO	Written exam	YES		ECTS (total)	5	

2.10. Required literature (available in the library and/or via other media)

Title	Number of copies in the library	Availability via other media	Title	Number of copies in the library	Availability via other media
Evans, A.M. (1990): *Ore geology and industrial minerals*, Blackwell, London, 389 p.			**Robb, L. (2005): *Introduction fo ore-forming processes,* Blackwell Science Ltd.**	**YES**	**YES**
Sawkins, F.J. (1990): *Metal deposits in relation to plate tectonics,* Springer Verlag, 460 p.			**Ridley, J. (2013): *Ore Deposit Geology,* Cambridge Univeristy Press, Sambridge, UK.**	**YES**	**YES**

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2.11. Optional literature	Ineson, P.R. (1989): *Practical ore microscopy*, Longman earth sci.ser., 181 p. Marković, S. (2002): *Hrvatske mineralne sirovine,* Inst. geol. istr., 541 p.			**Evans, A.M. (1990): *Ore geology and industrial minerals*, Blackwell, London, 389 p.** **Sawkins, F.J. (1990): *Metal deposits in relation to plate tectonics,* Springer Verlag, 460 p.**		

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Table 2B Description of the course that was amended and/or modified – Sedimentary Facies Analysis

1. COURSE DECRIPTION – GENERAL INFORMATION		
	Before the modification	**After the modification**
1.1. Course teacher	Assistant Professor Katarina Gobo, PhD	Assistant Professor Katarina Gobo, PhD
1.2. Name of the course	Analysis and interpretation of facies	**Sedimentary Facies Analysis**
1.10. Associate teachers		**Assistant according to the assignment schedule (exercises)**
1.11. tudy programme (undergraduate, graduate, integrated)	Undergraduate	Undergraduate
1.12. tatus of the course	Mandatory	Mandatory
1.13. ear of the study	3rd	3rd
1.14. CTS credits	5	5
1.15. ype of instruction (number of hours L + E + S + e-learning)	45 + 30 + 0 + 0	45 + 30 + 0 + 0
1.16. xpected enrolment in the course	30 – 35	30 – 35
1.10. Level of application of e-learning (level 1, 2, 3), percentage of online instruction (max. 20%)	Level 1, up to 3 %	Level 1, up to 3 %
2.1. Course objectives	The basic knowledge and skills on facies analysis and interpretation realized on sedimentary successions and profiles	**To introduce students with recent and fossil sedimentary facies and depositional environments and methods for their analysis and interpretation**
2.2. Course enrolment requirements and/or entry competences	Physical Geology, Stratigraphy, Sedimentary Petrology	**Sedimentary Petrology – passed** **Field Course in Geology II – passed**

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required for the course		
2.3. Learning outcomes at the level of the programme to which the course contributes	The basic knowledge and skills for paleoenvironments reconstruction. The basic knowledge and skills for understanding recent environments and their protection. GL_2) Knowledge and understanding of the essential features, processes, materials, history and the development of the Earth and life. GL_3) Basic knowledge and understanding of the key aspects and concepts of geology. GL_4) Knowledge of common terminology and nomenclature and the use of bibliography in Geosciences. GL_6) Awareness and understanding of the temporal and spatial dimensions in Earth processes. GL_11) Ability to create simple geological models. GL_18) Ability to integrate field and laboratory evidence with theory following the sequence from observation to recognition, synthesis and modelling. GL_22) Basic ability to apply appropriate technology and use relevant methods. GL_24) Basic ability to independently analyse earth materials in the field and laboratory and to describe, process, document and report the results. GL_26) Basic ability to combine theory and practice to complete geological tasks. GL_35) Ability to work effectively as an individual and as a member of a team. GL_39) Basic ability to prepare, process, interpret and present data, using appropriate qualitative and quantitative techniques and packages.	**1) Recognise and apply basic and specific knowledge related to the fundamental laws of natural science in the interpretation of geological processes.** **2) Identify basic geological processes and geological materials, and connect them with the development of life on Earth and Earth itself.** **3) Use geological maps, domestic and foreign literature and databases, as well as other sources of information.** **4) Design and generate simple geological models.** **5) Communicate and discuss ideas and solutions of geological problems with colleagues and experts.**
2.4. Expected learning outcomes at the level of the course (3-10 learning outcomes)	The course gives a basic knowledge needed for analysis of depositional sequences and sedimentary basins, for a location and exploitation of mineral resources and a recent environments protection.	**1) Recognise, describe and explain depositional processes in various recent and fossil depositional environments based on depositional textures and structures.** **2) Apply suitable methods in facies analysis.**

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			3) Prepare, process, present and interpret sedimentological data and design simple sedimentary models independently or in a group. **4) Recognise trends in depositional sequences (outcrops, sedimentological logs) and explain which factors can influence changes in depositional sequences.** **5) Apply acquired knowledge in the interpretation of sedimentary sequences, sedimentary basins and in the discovery and exploitation of mineral resources (e.g., hydrocarbons, coal, water, salt).** **6) Apply acquired knowledge and laws of natural science with the aim of environmental protection.** **7) Relate and compare the occurrence of different body fossils, trace fossils, sedimentary textures and structures in the sedimentary record with relative changes in sea level.**	
2.5. Course content (syllabus)	1) Facies (lithofacies, biofacies, microfacies, descriptive facies, genetic facies), facies associations, facies sequences, architectural elements and lateral profiles. 2) Facies models. 3) Sedimentary logs, drawing sedimentary logs. 4) Fundamental principles of sequence stratigraphy 5) Sedimentary basins, sedimentary basins and plate tectonics. 6) Alluvial fans. 7) Rivers, characteristic facies and facies associations, glacial and glaciofluvial facies and environments. 8) Deltas, types of deltas, tripartite division of deltas, delta successions, fan deltas, Gilbert deltas. 9) Clastic and carbonate coasts, coastal processes and environments. 10) Clastic and carbonate shelfs, carbonate platforms shelfal processes, shelfal facies and associations. 11) Estuary and incised valleys. 12) Deepsea environments, deep-sea turbidites, debrites, slumps and slides, olistoliths, contourites, pelagic and hemipelagic sediments. 13) Aeolian sediments and environments.		**1) Sediments and sedimentary rocks, sedimentary textures and structures, palaeotransport indicators, flow regime and bedforms,** facies, facies associations, facies sequences, sedimentological logs and lateral profiles, architectural elements and facies models **2) Glacial and lacustrine sediments and environments** 3) Aeolian sediments and environments 4) Alluvial fans 5) Fluvial sediments and environments 6) Deltas, types of deltas, Gilbert-type deltas, delta classifications 7) Wave-worked shallow-marine clastic sediments and environments, coasts and shelf 8) Tidal shallow-marine clastic sediments and environments, estuaries and incised valleys **9) Shallow-marine carbonate sediments and environments, evaporites** 10) Deep-marine sediments and environments, turbidites, debrites, slumps, olistoliths, contourites, pelagic and hemipelagic sediments 11) Sedimentary basins and plate tectonics **12) Ichnology, trace fossils and ichnofacies** 13) Sequence stratigraphy	
2.6. Format of instruction:	☒ lectures	☒ independent	☒ lectures	☒ independent

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<table>
<tr><td></td><td colspan="9">☐ seminars and workshops
☒ exercises
☐ online in entirety
☐ partial e-learning
☐ field work</td><td colspan="9">assignments
☐ multimedia and the internet
☐ laboratory
☐ work with mentor
☐ (other)</td><td colspan="9">☐ seminars and workshops
☒ exercises
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☐ field work</td><td colspan="9">assignments
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☐ work with mentor
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<tr><td>2.7. Comments:</td><td colspan="18"></td><td colspan="18"></td></tr>
<tr><td>2.8. Student obligations</td><td colspan="18"></td><td colspan="18"></td></tr>
<tr><td rowspan="6">2.9. Monitoring student work</td><td>Class attendance</td><td>YES</td><td></td><td>Research</td><td></td><td>NO</td><td>Oral exam</td><td>YES</td><td></td><td>Class attendance</td><td>YES</td><td></td><td>Research</td><td></td><td>NO</td><td>Oral exam</td><td>YES</td><td></td></tr>
<tr><td>Experimental work</td><td></td><td>NO</td><td>Report</td><td></td><td>NO</td><td>(other)</td><td></td><td>NO</td><td>Experimental work</td><td></td><td>NO</td><td>Report</td><td></td><td>NO</td><td>(other)</td><td></td><td>NO</td></tr>
<tr><td>Essay</td><td></td><td>NO</td><td>Seminar paper</td><td></td><td>NO</td><td>(other)</td><td></td><td>NO</td><td>Essay</td><td></td><td>NO</td><td>Seminar paper</td><td></td><td>NO</td><td>(other)</td><td></td><td>NO</td></tr>
<tr><td>Preliminary exam</td><td>YES</td><td></td><td>Practical work</td><td>YES</td><td></td><td>(other)</td><td></td><td>NO</td><td>Preliminary exam</td><td>YES</td><td></td><td>Practical work</td><td>YES</td><td></td><td>(other)</td><td></td><td>NO</td></tr>
<tr><td>Project</td><td></td><td>NO</td><td>Written exam</td><td>YES</td><td></td><td>ECTS (total)</td><td colspan="2">5</td><td>Project</td><td></td><td>NO</td><td>Written exam</td><td>YES</td><td></td><td>ECTS (total)</td><td colspan="2">5</td></tr>
<tr><td colspan="18"></td></tr>
<tr><td rowspan="5">2.10. Required literature (available in the library and/or via other media)</td><td colspan="9">Title</td><td colspan="3">Number of copies in the library</td><td colspan="3">Availability via other media</td><td colspan="9">Title</td><td colspan="3">Number of copies in the library</td><td colspan="3">Availability via other media</td></tr>
<tr><td colspan="9">Tišljar, J. (2004): Sedimentologija klastičnih i silicijskih taložina, Institut za geološka istraživanja, Zagreb, 426 p.</td><td colspan="3">YES</td><td colspan="3">NO</td><td colspan="9">Nichols, G. (2009): Sedimentology and Stratigraphy, 2nd ed., John Wiley & Sons, 419 p.</td><td colspan="3">YES</td><td colspan="3">YES</td></tr>
<tr><td colspan="9">Tišljar, J. (1994): Sedimentne stijene, Školska knjiga, Zagreb.</td><td colspan="3">YES</td><td colspan="3">NO</td><td colspan="9">Tišljar, J. (1994): Sedimentne stijene, Školska knjiga, Zagreb, 422 p.</td><td colspan="3">YES</td><td colspan="3">NO</td></tr>
<tr><td colspan="9">Tucker, M.E. (2001): Petrologija sedimenata.</td><td colspan="3">YES</td><td colspan="3">NO</td><td colspan="9">Tišljar, J. (2004): Sedimentologija klastičnih i silicijskih taložina. Institut za geološka istraživanja, Zagreb, 426 p.</td><td colspan="3">YES</td><td colspan="3">NO</td></tr>
<tr><td colspan="9">Nichols, G. (2003): Sedimentology and Stratigraphy, Blackwell Science Ltd.</td><td colspan="3">YES</td><td colspan="3">NO</td><td colspan="9">Tucker, M.E. (2001): Sedimentary Petrology. Blackwell Sci. Publ. Oxford, 261 pp., translation by</td><td colspan="3">YES</td><td colspan="3">NO</td></tr>
</table>

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				Medunić, G. (2008): *Petrologija sedimenata*. AZP Grafis, Samobor, 262 p.		
2.11. Optional literature	Walker, R.G., James, N.P. (eds.) (1992): *Facies models,* Geological Association of Canada.			**Boggs, S.Jr. (2006): *Principles of Sedimentology and Stratigraphy, 4th edition*, Pearson Education, Upper Saddle River, New Jersey, 662 p. (PDF)** **Posamentier, H.W., Walker, R.G. (2006): *Facies models revisited,* Society for Sedimentary Geology (SEPM), Tulsa, Oklahoma, 527 p. (PDF)** **Reading, H.G. (1996): *Sedimentary Environments: Processes, Facies and Stratigraphy, 3rd edition*, Blackwell Publishing, 688 p. (PDF)**		

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Table 2B Description of the course that was amended and/or modified – Bachelor Thesis

1. COURSE DECRIPTION – GENERAL INFORMATION		
	Before the modification	**After the modification**
1.1. Course teacher		
1.2. Name of the course	Seminar III (Final Seminar)	**Bachelor Thesis**
1.3. Associate teachers		
1.4. Study programme (undergraduate, graduate, integrated)	Undergraduate	Undergraduate
1.5. Status of the course	Mandatory	Mandatory
1.6. Year of the study	3rd	3rd
1.7. ECTS credits	2	**4**
1.8. Type of instruction (number of hours L + E + S + e-learning)	0 + 0 + 30 + 0	0 + 0 + **60** + 0
1.9. Expected enrolment in the course		**30 – 35**
1.10. Level of application of e-learning (level 1, 2, 3), percentage of online instruction (max. 20%)		**Level 1, up to 5 %**
2.1. Course objectives	To develop the student's ability to independently use scientific and professional literature.	**Train students to independently use scientific and technical professional literature, independently read and interpret data from geological maps, and independently write and present research results.**
2.2. Course enrolment requirements and/or entry competences required for the course	Passed all courses from the 1st and 2nd year of study, and attended all courses from the winter semester of the 3rd year of study.	Passed all courses from the 1st and 2nd year of study, and attended all courses from the winter semester of the 3rd year of study.
2.3. Learning outcomes at the level of the programme to which the course contributes		**1) Recognise and apply basic and specific knowledge related to the fundamental laws of natural science in the interpretation of geological processes.**

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			2) Identify basic geological processes and geological materials, and connect them with the development of life on Earth and Earth itself. **3) Select and use suitable geological methods and specific technologies in solving geological problems.** **4) Apply information technologies (IT) when processing and presenting data.** **5) Use geological maps, domestic and foreign literature and databases, as well as other sources of information.** **6) Independently analyse geological samples in the laboratory, write and present results of research.** **7) Organise field and laboratory data and compare them with acquired professional knowledge.** **8) Communicate and discuss ideas and solutions of geological problems with colleagues and experts.** **9) Design and generate simple geological models.**	
2.4. Expected learning outcomes at the level of the course (3-10 learning outcomes)			**1) Apply acquired professional knowledge and skills in processing a given geological problem.** **2) Critically evaluate own observations and results within the framework of relevant scientific and professional knowledge.** **3) Create a written report on the researched problem using IT technologies.** **4) Publicly present the results of the research before the expert committee, students and other members of the professional public.** **5) Form attitudes about the role of geology in the development of knowledge, valuation of goods, spatial planning, improvement of the quality of life and preservation of the environment.**	
2.5. Course content (syllabus)	During the semester, the student refers to one published paper from a reputable journal, about which he prepares a written composition and presents it orally in front of students and teachers.		**The student works independently on one scientific research or professional topic related to the undergraduate study of geology.**	
2.6. Format of instruction:	☐ lectures ☐ seminars and workshops ☐ exercises	☒ independent assignments ☐ multimedia and the	☐ lectures ☐ seminars and workshops ☐ exercises	☒ independent assignments ☐ multimedia and the

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	☐ online in entirety ☐ partial e-learning ☐ field work	internet ☐ laboratory ☒ work with mentor ☐ (other)	☐ online in entirety ☐ partial e-learning ☐ field work	internet ☐ laboratory ☒ work with mentor ☐ (other)
2.7. Comments:			**An increase of seminar hours from 30 to 60, and an increase in the number of ECTS credits from 2 to 3 is requested in order to harmonize with the content of the course.**	
2.8. Student obligations	Presentation and defense in front of students and teachers.		**Submission of written work, and presentation and defense in front of students and teachers.**	

2.9. Monitoring student work	Class attendance		NO	Research	YES		Oral exam		NO	Class attendance		NO	Research	YES		Oral exam		NO
	Experimental work		NO	Report		NO	(other)		NO	Experimental work		NO	Report		NO	(other)		NO
	Essay		NO	Seminar paper	YES		(other)		NO	Essay		NO	Seminar paper	YES		(other)		NO
	Preliminary exam		NO	Practical work	YES		(other)		NO	Preliminary exam		NO	Practical work	YES		(other)		NO
	Project		NO	Written exam		NO	ECTS (total)	2		Project		NO	Written exam		NO	ECTS (total)	**4**	

2.10. Required literature (available in the library and/or via other media)	**Title**	**Number of copies in the library**	**Availability via other media**	**Title**	**Number of copies in the library**	**Availability via other media**
				Scientific and professional articles and other relevant literature.	**YES**	**YES**
2.11. Optional literature						

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Table 2B Description of the course that was amended and/or modified – Principles of Engineering Geology

1. COURSE DECRIPTION – GENERAL INFORMATION		
	Before the modification	**After the modification**
1.1. Course teacher	Associate Professor Martin Krkač, PhD	Associate Professor Martin Krkač, PhD
1.2. Name of the course	Engineering Geology	**Principles of Engineering Geology**
1.3. Associate teachers	Assistant Hrvoje Lukačić, mag.ing.geol., mag.ing.min.	Assistant Hrvoje Lukačić, mag.ing.geol., mag.ing.min.
1.4. Study programme (undergraduate, graduate, integrated)	Undergraduate	Undergraduate
1.5. Status of the course	Mandatory	**Elective**
1.6. Year of the study	3rd	3rd
1.7. ECTS credits	4	4
1.8. Type of instruction (number of hours L + E + S + e-learning)	30 + 15 + 0 + 0	30 + **30** + 0 + 0
1.9. Expected enrolment in the course	25	25
1.10. Level of application of e-learning (level 1, 2, 3), percentage of online instruction (max. 20%)	Level 1, up to 3%	**Level 2, up to 5 %**
2.1. Course objectives	To acquire expert terminology and principles of engineering geology: engineering properties and problems related to certain groups of rocks; methods and results of engineering geological research. To understand the role of engineering geological research in geotechnics/mining.	**To acquire basic knowledge related to soils, rocks, water, geomorphological and geodynamic processes relevant to the engineering geology.**
2.2. Course enrolment requirements and/or entry competences required for the course		**Completed courses Sedimentary Petrology, Igneous Petrology, Metamorphic Petrology, and Structural Geology and Tectonics.**
2.3. Learning outcomes at the level of the programme to which	1) Knowledge and understanding of the basic characteristics of Earth's materials and processes, relevant for applications in geological and geotechnical engineering.	**1) To recognize and apply basic and specific knowledge related to basic natural-scientific laws in the interpretation of geological processes.**

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the course contributes	2) Understanding the scope of applied geology disciplines. 3) Basic ability to recognize and analyze problems, which solution involves the use of methods of engineering geology, soil mechanics and rock mechanics. 4) Basic ability to combine theory and practical work in the execution of engineering geology assignments.	**2) To choose and apply appropriate geological methods and specific technologies in solving geological problems.** **3) To recognize problems related to sampling and data processing during field and laboratory tests.** **4) To recognize the role of geology in the development of knowledge, validation of goods, spatial planning, improvement of the quality of life and preservation of the environment.**
2.4. Expected learning outcomes at the level of the course (3-10 learning outcomes)	1) Knowledge and understanding of the basic characteristics of Earth's materials and processes, relevant for applications in geological and geotechnical engineering. 2) Understanding the scope of applied geology disciplines. 3) Understanding the application and responsibility of engineering geology and its role in society, including the aspects of environmental protection. 4) Basic ability to recognize and analyse problems, which solution involves the use of methods of engineering geology, soil mechanics and rock mechanics. 5) Ability to conduct appropriate analysis, to interpret the data and construction of conclusions.	**1) To define the terms "Engineering geology" and "Geological engineering" and to describe their relations with other sciences.** **2) To define the basic physical and mechanical properties of rocks and soils.** **3) To describe basic methods for testing of physical and mechanical properties of rocks and soils** **4) To understand the relations between the physical and mechanical properties of rocks and soils** **5) To implement soil classification based on laboratory results.** **6) To define rock discontinuity properties.** **7) To list criteria for rock mass classification.** **8) To describe the influence of water on the physical and mechanical properties of rocks and soils.** **9) To describe exogenic and endogenic processes and phenomena.** **10) To describe methods of engineering geological investigations for different engineering purposes.**
2.5. Course content (syllabus)	1 Lecture: INTRODUCTION TO THE ENGINEERING GEOLOGY; BASICS OF ENGINEERING GEOLOGICAL INVESTIGATIONS. Role of the engineering geologist. Elements of investigations. Types of investigations; 2 Exercise: Basics of mechanics 3 Lecture: ENGINEERING SOIL. Engineering soil description, Engineering properties of soils. Geomechanical classification; ENGINEERING PROPERTIES OF ROCKS. Intact rock. Rock mass. Geomechanical classification of rocks.	**T1: Lecture – Introduction to the engineering geology; Exercise – Introduction exercise** **T2: Lecture – Basics of mechanics; Exercise: Mohr's circle** **T3: Lecture – Soils: Genesis; Exercise: Particle size distribution** **T4: Lecture – Soils: Physical properties; Exercise: Plasticity chart** **T5: Lecture – Soils: Mechanical properties; Exercise: Mohr-Coulomb failure criteria** **T6: Lecture – Classification and description of the soil; Exercise: Classification of fine and coarse soil mixtures**

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	4. Exercise: Engineering geological description of rocks and soil 5. Colloquium 1 6. Lectures: CLASTIC SEDIMENTARY ROCKS. Geological description. Engineering properties of sandstone and conglomerate. Engineering problems with shales and mudstones. Engineering problems in sandstones and shales; SOLUBLE ROCKS: CARBONATE AND EVAPORATE ROCKS. Geological description. Dissolution processes and their effects. Engineering properties of limestones and evaporites; 7. Lectures: INTRUSIVE MAGMATIC ROCKS. Geological description. Weathering of intrusive rocks. Engineering properties of intrusive rocks; VOLCANIC ROCKS. Geological description. Weathering of volcanic rocks. Engineering problems in volcanic rocks; METAMORPHIC ROCKS. Geological description. Weathering of metamorphic rocks. Engineering problems in metamorphic rocks; 8. Lectures: RESIDUAL SOILS. Geological description. Engineering properties; COLLUVIUM AND TALLUS. Geological features. Engineering problems in debris; COARSE-GRAINED SOILS. Geological description. Engineering features. Engineering problems in sands and gravels. 9. Lectures: CLAY SOILS. Geological description. Engineering problems in clays; LOESS. Geological description. Engineering characteristics of loess; COOL CLIMATE SOILS. Engineering features of tills, fluvio-glacial deposits, quick clays and permafrost. Engineering problems in soils of cold climates 10. Colloquium 2 11. Lectures: GROUNDWATER. Basic hydrogeological parameters. Engineering meaning. Groundwater control methods; ENGINEERING GEOLOGY AND GEODYNAMICAL PROCESSES. Risk and assessment of geohazards. Earthquakes and related processes. Volcanic processes. Landslides. Subsidence. Swelling soils. Coastal processes. 12. MEASURING INSTRUMENTS. Basic components of instruments. Types of instruments and their application. Planning of measurement programs; ENGINEERING INVESTIGATION.	**T7: Lecture – Intact rock; Exercise: 1st preliminary exam** **T8: Lecture – Rock mass; Exercise: Rock Quality Designation (RQD)** **T9: Lecture – Rock mass classification; Exercise: RMR classification** **T10: Lecture – Water in engineering; Exercise: GSI classification** **T11: Lecture – Landslides; Exercise: Total and effective stress in soils** **T12: Lecture – Weathering and erosion; Exercise: Rock slope kinematic analysis (planar failure)** **T13: Lecture – Earthquakes; Exercise: Rock slope kinematic analysis (wedge failure)** **T14: Lecture – Engineering geological investigations; Exercise: Rock slope kinematic analysis (toppling)** **T15: Lecture – Engineering geological and geotechnical reports; Exercise: 2nd preliminary exam**

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<table>
<tr><td></td><td colspan="6">Maps. Remote sensing. Underground investigation; USE OF ROCKS IN CONSTRUCTION. Aggregates. Stone blocks;
13. Exercises: Graphical determination of slope stability. Geomechanical classification of rocks.
14. Exercises: Creating a borehole profile. Interpretation of engineering geological units.
15. Colloquium 3</td><td colspan="6"></td></tr>
<tr><td>2.6. Format of instruction:</td><td colspan="3">☒ lectures
☐ seminars and workshops
☒ exercises
☐ online in entirety
☐ partial e-learning
☐ field work</td><td colspan="3">☐ independent assignments
☐ multimedia and the internet
☐ laboratory
☐ work with mentor
☐ (other)</td><td colspan="3">☒ lectures
☐ seminars and workshops
☐ exercises
☐ online in entirety
☒ partial e-learning
☐ field work</td><td colspan="3">☐ independent assignments
☐ multimedia and the internet
☐ laboratory
☐ work with mentor
☒ design exercises (other)</td></tr>
<tr><td>2.7. Comments:</td><td colspan="6"></td><td colspan="6"></td></tr>
<tr><td>2.8. Student obligations</td><td colspan="6">Attending classes. Completing the assignments during the exercises during the semester. During the semester the knowledge will be by three colloquiums.</td><td colspan="6">During the semester, students are obligated to attend lectures and exercises, attend two preliminary exams, to complete all programs/assignments from exercises. Students need to pass a written exam (if they did not pass any of the two preliminary exams) and an oral exam to complete the course.</td></tr>
<tr><td rowspan="5">2.9. Monitoring student work</td><td>Class attendance</td><td>YES</td><td></td><td>Research</td><td></td><td>NO</td><td>Oral exam</td><td>YES</td><td>NO</td><td>Class attendance</td><td>YES</td><td></td><td>Research</td><td></td><td>NO</td><td>Oral exam</td><td>YES</td><td></td></tr>
<tr><td>Experimental work</td><td></td><td>NO</td><td>Report</td><td></td><td>NO</td><td>(other)</td><td></td><td>NO</td><td>Experimental work</td><td></td><td>NO</td><td>Report</td><td></td><td>NO</td><td>(other)</td><td></td><td>NO</td></tr>
<tr><td>Essay</td><td></td><td>NO</td><td>Seminar paper</td><td></td><td>NO</td><td>(other)</td><td></td><td>NO</td><td>Essay</td><td></td><td>NO</td><td>Seminar paper</td><td></td><td>NO</td><td>(other)</td><td></td><td>NO</td></tr>
<tr><td>Preliminary exam</td><td>YES</td><td></td><td>Practical work</td><td>YES</td><td></td><td>(other)</td><td></td><td>NO</td><td>Preliminary exam</td><td>YES</td><td></td><td>Practical work</td><td>YES</td><td></td><td>(other)</td><td></td><td>NO</td></tr>
<tr><td>Project</td><td></td><td>NO</td><td>Written exam</td><td></td><td>NO</td><td>ECTS (total)</td><td>4</td><td></td><td>Project</td><td></td><td>NO</td><td>Written exam</td><td>YES</td><td></td><td>ECTS (total)</td><td>4</td><td></td></tr>
<tr><td rowspan="2">2.10. Required literature (available in the library and/or via other media)</td><td colspan="3">Title</td><td>Number of copies in the library</td><td colspan="2">Availability via other media</td><td colspan="3">Title</td><td colspan="2">Number of copies in the library</td><td colspan="2">Availability via other media</td></tr>
<tr><td colspan="3">Johnson, R.B., DeGraff, J.V. (1988): Principles of engineering geology, John Wiley and So., New York, 497 p.</td><td></td><td colspan="2"></td><td colspan="3">Selected chapters: De Vallejo, L.G., Ferrer, M., de Freitas, M. (2011): Geological Engineering, CRC Press, 700 p.</td><td colspan="2">YES</td><td colspan="2">NO</td></tr>
</table>

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	Goodman, R.E. (1993): *Engineering geology. Rock in engineering construction,* John Wiley and So., New York, 412 p.			**De Freitas, M.H. (2009): *Engineering Geology. Principles and Practice,* Springer, 450 p.**	**NO**	**YES**
2.11. Optional literature	Waltham, T. (2002): *Foundations of engineering geology, 2nd ed,* Spon Press, London, 92 p. Bell, F.G. (2000): *Engineering properties of soils and rocks,* Blackwell Science, Oxford, 482 p.			Waltham, T. (2002): *Foundations of engineering geology, 2nd ed,* Spon Press, London, 92 p. Bell, F.G. (2000): *Engineering properties of soils and rocks,* Blackwell Science, Oxford, 482 p. **Goodman, R.E. (1993): *Engineering geology. Rock in engineering construction,* John Wiley and So., New York, 412 p.** **Johnson, R.B., J.V. DeGraff (1988): *Principles of engineering geology,* John Wiley and So., New York, 497 p.**		

DESCRIPTION OF AMENDMENTS AND MODIFICATIONS TO UNDERGRADUATE, GRADUATE AND INTEGRATED UNDERGRADUATE AND GRADUATE STUDY PROGRAMMES

Table 2B Description of the course that was amended and/or modified – Hydrogeology

1. COURSE DECRIPTION – GENERAL INFORMATION		
	Before the modification	**After the modification**
1.1. Course teacher	Assistant Professor Zoran Kovač, PhD	Assistant Professor Zoran Kovač, PhD
1.2. Name of the course	Hydrogeology	Hydrogeology
1.3. Associate teachers		
1.4. Study programme (undergraduate, graduate, integrated)	Undergraduate	Undergraduate
1.5. Status of the course	Mandatory	**Elective**
1.6. Year of the study	3rd	3rd
1.7. ECTS credits	4	**3**
1.8. Type of instruction (number of hours L + E + S + e-learning)	30 + 15 + 0 + 0	30 + 15 + 0 + 0
1.9. Expected enrolment in the course	25	25
1.10. Level of application of e-learning (level 1, 2, 3), percentage of online instruction (max. 20%)		**Level 1, 5 %**
2.1. Course objectives	Definition and goal of hydrogeology, its historical development and connection with other geological disciplines. The total amount and distribution of water on Earth. Hydrological cycle and water balance. Precipitation, runoff, evapotranspiration and infiltration, base flow. Origin of groundwater, types of groundwater movement. Porosity, permeability, types of aquifers. Darcy's law and its limits of validity. Potential and hydraulic gradient. Hydraulic conductivity and transmissivity. Elastic features of the aquifer-storage. Specific yield. The main equations of groundwater flow and conditions for solving the flow equations. Pumping test. Calculation of hydrogeological parameters from experimental pumping test data using analytical solutions of flow equations for confined, semi-confined and unconfined types of aquifers. Simulations of aquifer reaction to	**The student will acquire basic knowledge about:** **1) hydrological cycle;** **2) hydrological and meteorological parameters;** **3) aquifer types;** **4) laws of groundwater flow;** **5) hydrogeological parameters;** **6) pumping test;** **7) hydrogeochemical characteristics of the aquifer;** **8) hydrogeological characteristics of the karst.**

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	pumping (analytical methods). Specific capacity of a well, lowering equation in the well, efficiency of the well. The principle of superposition. Limited aquifers. Basic concepts of karst hydrogeology. Groundwater reserves and exploitation.	
2.2. Course enrolment requirements and/or entry competences required for the course	Physical Geology Physics Mathematics I Mathematics II	**Passed courses:** **Physical Geology** **Physics** **Mathematics I** **Mathematics II**
2.3. Learning outcomes at the level of the programme to which the course contributes	Student will be able to: 1) Knowledge and understanding of the essential features, processes, materials, history and the development of the Earth and life. 2) Basic knowledge and understanding of the key aspects and concepts of geology. 3) Knowledge of the common terminology and nomenclature and the use of bibliography in Geosciences. 4) An awareness of the wider spectrum of geological disciplines. 5) Awareness of the applications and responsibilities of Geology and its role in society including its environmental aspects. 6) Understanding the need of a rational use of earth resources. 7) Knowledge of appropriate solution patterns for geological problems. 8) Ability to formulate and test hypotheses. 9) Basic ability to become familiar with new geological methods and technologies. 10) Basic ability to apply appropriate technology and use relevant methods. 11) Ability to use simple quantitative methods and to apply them to geological problems. 12) Ability to conduct appropriate experiments, to analyse and interpret data and draw conclusions. 13) Basic awareness of relevant state-of-the-art technologies and their application	**Student will be able to:** **1) Recognise and apply basic and specific knowledge related to the fundamental laws of natural science in the interpretation of geological processes.** **2) Identify basic geological processes and geological materials, and connect them with the development of life on Earth and Earth itself.** **3) Select and use suitable geological methods and specific technologies in solving geological problems.** **4) Apply information technologies (IT) when processing and presenting data.** **5) Identify problems related to sampling and data processing in field and laboratory research.** **6) Organise field and laboratory data and compare them with acquired professional knowledge.** **7) Recognise the role of geology in knowledge development, valuation of goods, spatial arrangement, improvement of life quality and environmental preservation.** **8) Plan further professional development on the basis of acquired geological knowledge and developed specific skills.**

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	14) Basic ability to solve numerical problems using computer and non-computer based techniques 15) Ability to work effectively as an individual and as a member of a team 16) Ability to organise their own work independently 17) Basic ability to prepare, process, interpret and present data, using appropriate qualitative and quantitative techniques and packages	
2.4. Expected learning outcomes at the level of the course (3-10 learning outcomes)		**Student will be able to:** **1) Explain basic hydrological and meteorological parameters;** **2) Create frequency and duration curves of water level / flow;** **3) Calculate the value of effective infiltration based on groundwater level fluctuations;** **4) Make equipotential map and determine the direction of groundwater flow;** **5) Apply Darcy's law in calculating the total flow of water through an aquifer;** **6) Explain the main hydrogeological parameters;** **7) Calculate the value of hydraulic conductivity based on the granulometric composition data;** **8) Calculate the values of hydrogeological parameters of the aquifer and well parameters based on the results of the pumping test;** **9) Explain the difference between basic geochemical conditions in an aquifer;** **10) Determine the hydrogeochemical facies of groundwater.**
2.5. Course content (syllabus)	Definition and goal of hydrogeology, its historical development and connection with other geological disciplines. The total amount and distribution of water on Earth. Hydrological cycle and water balance. Precipitation, runoff, evapotranspiration and infiltration, base flow. Origin of groundwater, types of groundwater movement. Porosity, permeability, types of aquifers. Darcy's law and its limits of validity. Potential and hydraulic gradient. Hydraulic conductivity and transmissivity. Elastic features of the aquifer-storage. Specific yield. The main equations of groundwater flow and conditions for solving the flow equations. Pumping test. Calculation of hydrogeological	**L1 - introduction to the course, hydrogeology as a scientific discipline, the total amount and distribution of water on Earth, the global water balance, water consumption and the threat to potable water supply. E1 - introductory exercises (assessment of the relationship between pumping volume and water consumption in the area of the Zagreb aquifer; manual and / or software).** **L2 - hydrological cycle and its components, precipitation, evapotranspiration, potential evapotranspiration, runoff. E2 - calculation of the average amount of precipitation for the basin (manual and / or software).**

	parameters from experimental pumping test data using analytical solutions of flow equations for confined, semi-confined and unconfined types of aquifers. Simulations of aquifer reaction to pumping (analytical methods). Specific capacity of a well, lowering equation in the well, efficiency of the well. The principle of superposition. Limited aquifers. Basic concepts of karst hydrogeology. Groundwater reserves and exploitation.	**L3 – river water level, flow, flow curve, frequency and duration of water level / flow, specific inflow, base flow. E3 - creation of frequency and duration flow curves (manual and / or software). L4 - infiltration, groundwater distribution, porosity, permeability, types of aquifers, types of groundwater movement. E4 - determination of effective infiltration and calculation of evaporation and evapotranspiration (manual and / or software). L5 - Darcy's law and its validity limits, Bernoulli's equation, potential, piezometric height, equipotential maps, hydraulic gradient, generalization of Darcy's law. E5 - construction of equipotential map and calculation of total flow through an aquifer layer using Darcy's law (manual and / or software). L6 - hydrogeological parameters, groundwater flow equations, initial and boundary conditions. E6 - calculation of hydraulic conductivity using granulometric composition of the aquifer (manual and / or software). L7 - repetition of material with practical exercises. E7 - repetition of material with practical exercises. L8 - 1st colloquium. E8 - 1st colloquium L9 – pumping test, pumping well, observation well and choice of hydrogeological model. Selection of hydrogeological model for confined aquifers. E9 - calculation of hydrogeological parameters of a confined aquifer using Theis and Jacob-Cooper methods (manual and software). L10 - selection of hydrogeological model for semi-confined and unconfined aquifer layers. E10 - calculation of hydrogeological parameters of the semi-confined aquifer using the Hantush-Jacob method and the unconfined aquifer using the Neumann method (manual and software). L11 - determination of pumping well parameters, equation of total reduction in pumping well, well efficiency, limited aquifers. E11 - calculation of well efficiency and determination of the equation of total reduction in the pumping well; determination of lowering in case of limited aquifers (manually and / or software). L12 - basic hydrogeochemical characteristics of aquifers. E12 - determination of geochemical conditions prevailing in the aquifer (manual and / or software).**

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<table>
<tr><td></td><td colspan="9"></td><td colspan="9">L13 - hydrogeological characteristics of karst. E13 - determination of hydrogeochemical facies (manual and / or software).
L14 - 2nd colloquium. E14 - 2nd colloquium.
L15 - correction of colloquium. E15 - colloquium correction.</td></tr>
<tr><td>2.6. Format of instruction:</td><td colspan="9">☒ lectures
☐ seminars and workshops
☒ exercises
☐ online in entirety
☐ partial e-learning
☐ field work
☐ independent assignments
☐ multimedia and the internet
☐ laboratory
☐ work with mentor
☐ (other)</td><td colspan="9">☒ lectures
☐ seminars and workshops
☒ exercises
☐ online in entirety
☐ partial e-learning
☐ field work
☒ independent assignments
☐ multimedia and the internet
☐ laboratory
☐ work with mentor
☒ project exercises (other)</td></tr>
<tr><td>2.7. Comments:</td><td colspan="9"></td><td colspan="9">A decrease in ECTS points from 4 to 3 is requested, because the previous number of ECTS points did not correspond to the point value of the course.</td></tr>
<tr><td>2.8. Student obligations</td><td colspan="9">Regular attendance at classes and resolving all exercises from the workbook.</td><td colspan="9">Attendance at a minimum of 80 % of classes and completed workbook (submitted project assignments).</td></tr>
<tr><td rowspan="5">2.9. Monitoring student work</td><td>Class attendance</td><td>YES</td><td></td><td>Research</td><td></td><td>NO</td><td>Oral exam</td><td>YES</td><td></td><td>Class attendance</td><td>YES</td><td></td><td>Research</td><td>YES</td><td></td><td>Oral exam</td><td>YES</td><td></td></tr>
<tr><td>Experimental work</td><td></td><td>NO</td><td>Report</td><td></td><td>NO</td><td>(other)</td><td></td><td>NO</td><td>Experimental work</td><td></td><td>NO</td><td>Report</td><td></td><td>NO</td><td>(other)</td><td></td><td>NO</td></tr>
<tr><td>Essay</td><td></td><td>NO</td><td>Seminar paper</td><td></td><td>NO</td><td>(other)</td><td></td><td>NO</td><td>Essay</td><td></td><td>NO</td><td>Seminar paper</td><td></td><td>NO</td><td>(other)</td><td></td><td>NO</td></tr>
<tr><td>Preliminary exam</td><td>YES</td><td></td><td>Practical work</td><td>YES</td><td></td><td>(other)</td><td></td><td>NO</td><td>Preliminary exam</td><td>YES</td><td></td><td>Practical work</td><td>YES</td><td></td><td>(other)</td><td></td><td>NO</td></tr>
<tr><td>Project</td><td></td><td>NO</td><td>Written exam</td><td>YES</td><td></td><td>ECTS (total)</td><td>4</td><td></td><td>Project</td><td>YES</td><td></td><td>Written exam</td><td>YES</td><td></td><td>ECTS (total)</td><td>3</td><td></td></tr>
<tr><td rowspan="3">2.10. Required literature (available in the library and/or via other media)</td><td colspan="3">Title</td><td>Number of copies in the library</td><td colspan="2">Availability via other media</td><td colspan="3">Title</td><td colspan="3">Number of copies in the library</td><td colspan="3">Availability via other media</td></tr>
<tr><td colspan="3">Domenico, P.A., Schwartz, F.W. (19979: Physical and chemical hydrogeology, J. Willey & Sons, New York, 494 p.</td><td>NO</td><td colspan="2">YES</td><td colspan="3">Bačani, A. (2006): Hydrogeology I, University of Zagreb, Faculty of Mining, Geology and Petroleum Engineering</td><td colspan="3">YES</td><td colspan="3">NO</td></tr>
<tr><td colspan="3"></td><td></td><td colspan="2"></td><td colspan="3">Bačani, A., Vlahović, T. (2012): Hydrogeology. Application in construction,</td><td colspan="3">YES</td><td colspan="3">NO</td></tr>
</table>

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				University of Split, Faculty of Civil Engineering, Architecture and Geodesy		
2.11. Optional literature				**Žugaj, R. (2000): *Hydrology,* University of Zagreb, Faculty of Mining, Geology and Petroleum Engineering** **Domenico, P.A., Schwartz, F.W. (1997): *Physical and chemical hydrogeology,* J. Willey & Sons, New York, 494 p.**		

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Table 2B Description of the course that was amended and/or modified – Field course in Geology IIIA

1. COURSE DECRIPTION – GENERAL INFORMATION		
	Before the modification	**After the modification**
1.1. Course teacher	Associate Professor Borna Lužar-Oberiter, PhD	**Associate Professor Borna Lužar-Oberiter, PhD, Associate Professor Bojan Matoš, PhD**
1.2. Name of the course	Field course in Geology IIIA	Field course in Geology IIIA
1.3. Associate teachers		**Iva Olić, mag. geol.**
1.4. Study programme (undergraduate, graduate, integrated)	Undergraduate	Undergraduate
1.5. Status of the course	Mandatory	Mandatory
1.6. Year of the study	3rd	3rd
1.7. ECTS credits	2	2
1.8. Type of instruction (number of hours L + E + S + e-learning)	0 + 30 + 0 + 0	0 + **40** + 0 + 0
1.9. Expected enrolment in the course	30 – 35	**30**
1.10. Level of application of e-learning (level 1, 2, 3), percentage of online instruction (max. 20%)		**Level 1, up to 3 %**
2.1. Course objectives	Learn students how to use geological maps, hydrogeological and structural data.	**To acquaint students with basic methods of orientation in the field. Train students to recognize and interpret stratigraphic and structural elements in the field, and to collect and record appropriate quantitative and qualitative field data.**
2.2. Course enrolment requirements and/or entry competences required for the course	Involvement in courses Geological Mapping I, Hydrogeology and Structural Geology and Tectonics.	**Enrolled courses Geological Mapping and Structural Geology and Tectonics.**
2.3. Learning outcomes at the level of the programme to which	Mastering the use of geological maps. Getting knowledge to solve practical problems important for water supply. Analysis and interpretation of structural/tectonic history of the region	**1) Identify basic geological processes and geological materials, and connect them with the development of life on Earth and Earth itself.**

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the course contributes	based on collected data together with data presented on published geological maps.	**2) Select and use suitable geological methods and specific technologies in solving geological problems.** **3) Apply information technologies (IT) when processing and presenting data.** **4) Use geological maps, domestic and foreign literature and databases, as well as other sources of information.** **5) Conduct field research independently or in a group and collect, describe and classify geological samples.** **6) Identify problems related to sampling and data processing in field and laboratory research.** **7) Organise field and laboratory data and compare them with acquired professional knowledge.**
2.4. Expected learning outcomes at the level of the course (3-10 learning outcomes)	1. Spatial orientation in the field 2. Reading of the topographic maps in the filed 3. Independently leading of the fieldbook 4. Teamwork 5. Construction of the geological map in the field	**Students will be able to:** **1) Read a topographic map and orientate in the field with the help of a map, compass and applications for field work;** **2) Keep systematized and clear notes in the form of a field diary and geological field map;** **3) Identify and describe different types of lithologies and structural relationships;** **4) Identify linear and planar structural elements on an outcrop;** **5) Measure linear and planar structural elements on an outcrop;** **6) Determine paleostress field with calculation of stress axis,** **7) Recognize lithostratigraphic units and structural units in the field;** **8) Create a simple geological map containing basic structural and geological elements;** **9) Write a report on field research results.**
2.5. Course content (syllabus)	1. Field introduction 2. Individual work in field and camp 3. Recognition and descriptive analysis of deformational structures in regions composed of crystalline basement (metamorphic and igneous) and in sedimentary rocks. 4. Analysis and interpretation of structural/tectonic history of the region 5. Solving practical problems important for water supply	**1) Reading topographic maps and orientation in the field with the help of a map, compass and computer applications for field work** **2) Collecting notes in the form of a field diary and geological field map** **3) Identification and field description of different types of lithologies and structural relationships.** **4) Identification of linear and planar structural elements** **5) Measurements of linear and planar structural elements with a geological compass**

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		6) **Determination of paleostress field with calculation of stress axis and linear and planar structural elements.** **7) Recognition of lithostratigraphic and structural units in the field.** **8) Construction of a simple geological map containing basic structural and geological elements.** **9) Writing a final report.**
2.6. Format of instruction:	☐ lectures ☐ seminars and workshops ☐ exercises ☐ online in entirety ☐ partial e-learning ☒ field work ☐ independent assignments ☐ multimedia and the internet ☐ laboratory ☐ work with mentor ☐ (other)	☐ lectures ☐ seminars and workshops ☐ exercises ☐ online in entirety ☐ partial e-learning ☒ field work ☐ independent assignments ☐ multimedia and the internet ☐ laboratory ☐ work with mentor ☐ (other)
2.7. Comments:		**An increasement of course hours from 30 to 40 is requested.**
2.8. Student obligations	Independently make a geological map of a specific area, create a field diary and a detailed sedimentological column.	**Attend and actively participate in classes. Keep a field diary and a field map independently or in a group, and create a simple geological map and final report.**

2.9. Monitoring student work																		
	Class attendance		NO	Research	YES		Oral exam		NO	Class attendance	**YES**		Research		NO	Oral exam		NO
	Experimental work		NO	Report		NO	(other)		NO	Experimental work		NO	Report		NO	**Field map**	**YES**	
	Essay		NO	Seminar paper		NO	(other)		NO	Essay		NO	Seminar paper		NO	**Written report**	**YES**	
	Preliminary exam		NO	Practical work	YES		(other)		NO	Preliminary exam		NO	Practical work	YES		(other)		NO
	Project		NO	Written exam		NO	ECTS (total)	2		Project		NO	Written exam		NO	ECTS (total)	2	

2.10. Required literature (available in the library and/or via other media)	**Title**	**Number of copies in the library**	**Availability via other media**	**Title**	**Number of copies in the library**	**Availability via other media**
	Bahun, S. (1993): *Geološko kartiranje*	YES	NO	**Lisle, R.J., Brabham, P., Barnes, J.W. (2011): *Basic Geological Mapping, 5th Edition,* Wiley, Chichester, 230 p.**	**YES**	**NO**

DESCRIPTION OF AMENDMENTS AND MODIFICATIONS TO UNDERGRADUATE, GRADUATE AND INTEGRATED UNDERGRADUATE AND GRADUATE STUDY PROGRAMMES

	Davis, G.H., Reynolds, S.J. (1996) *Structural Geology of Rocks and Regions. 2nd ed*., John Wiley & Sons, New York, 776 str.	YES	NO	**Coe, A.L. (2010). *Geological Field Techniques,* Wiley-Blackwell, 323 p.**	**YES**	**NO**
	Domenico, P.A., F.W.Schwartz (1997): *Physical and chemical hydrogeology,* J. Willey & Sons	YES	NO			
2.11. Optional literature	Korbar et al. (2012): *Guidelines for the construction of Basic geological map of the Republic of Croatia* 1:50 000.			**Tucker, M. (2003): *Sedimentary Rocks in the Field,* Wiley, Chichester, 237 p.**		

DESCRIPTION OF AMENDMENTS AND MODIFICATIONS TO UNDERGRADUATE, GRADUATE AND INTEGRATED UNDERGRADUATE AND GRADUATE STUDY PROGRAMMES

Table 2B Description of the course that was amended and/or modified – Field course in Geology IIIB

1. COURSE DECRIPTION – GENERAL INFORMATION		
	Before the modification	**After the modification**
1.1. Course teacher	Assistant Professor Andrea Čobić, PhD Assistant Professor Katarina Gobo, PhD Assistant Professor Zoran Kovač, PhD Associate Professor Borna Lužar-Oberiter, PhD	**Assistant Professor Andrea Čobić, PhD** **Assistant Professor Katarina Gobo, PhD**
1.2. Name of the course	Field Course in Geology IIIB	Field Course in Geology IIIB
1.3. Associate teachers		
1.4. Study programme (undergraduate, graduate, integrated)	Undergraduate	Undergraduate
1.5. Status of the course	Mandatory	Mandatory
1.6. Year of the study	3rd	3rd
1.7. ECTS credits	7	**2**
1.8. Type of instruction (number of hours L + E + S + e-learning)	0 + 105 + 0 + 0	0 + **40** + 0 + 0
1.9. Expected enrolment in the course	25	25
1.10. Level of application of e-learning (level 1, 2, 3), percentage of online instruction (max. 20%)		**Level 1, up to 3 %**
2.1. Course objectives	Obtaining skills for construction of geological maps, applications of acquired knowledge on geology of mineral deposits and analyses and interpretation of facies.	**Learn how to work in the field, apply the knowledge gained from the courses Geology of mineral deposits and Sedimentary facies analysis in the field**
2.2. Course enrolment requirements and/or entry competences required for the course	Involvement in courses Geological Mapping II, Geology of Mineral Deposits and Analysis and interpretation of facies	**Enrolment in courses Geology of Mineral Deposits and Sedimentary Facies Analysis**
2.3. Learning outcomes at the level of the programme to which	Mastering the use of geological maps and skills to make new geological maps and interpretations of mineral deposits and sedimentary facies	**1) Recognise and apply basic and specific knowledge related to the fundamental laws of natural science in the interpretation of geological processes.**

the course contributes	GL_2) Knowledge and understanding of the essential features, processes, materials, history and the development of the Earth and life. GL_3) Basic knowledge and understanding of the key aspects and concepts of geology GL_6) Awareness and understanding of the temporal and spatial dimensions in Earth processes GL_8) Awareness of major geological paradigms, the extent of geological time and Plate Tectonics GL_9) Knowledge and understanding of the complex nature of interactions within the geosphere GL_11) Ability to create simple geological models GL_12) Some understanding of the complexity of geological problems and the feasibility of their solution GL_14) Basic ability in the formalisation and specification of problems whose solution involves the use of geological methods GL_15) Knowledge of appropriate solution patterns for geological problems GL_16) Basic ability to describe a solution at an abstract level GL_18) Ability to integrate field and laboratory evidence with theory following the sequence from observation to recognition, synthesis and modelling GL_19) Appreciation of issues concerning sample selection, accuracy, precision and uncertainty during collection, recording and analysis of data in the field and laboratory GL_21) Basic ability to become familiar with new geological methods and technologies GL_22) Basic ability to apply appropriate technology and use relevant methods	**2) Identify basic geological processes and geological materials, and connect them with the development of life on Earth and Earth itself.** **3) Apply information technologies (IT) when processing and presenting data.** **4) Perform relevant experiments and analyses independently or in a group and present data using suitable qualitative and quantitative methods.** **5) Use geological maps, domestic and foreign literature and databases, as well as other sources of information.** **6) Conduct field research independently or in a group and collect, describe and classify geological samples.** **7) Organise field and laboratory data and compare them with acquired professional knowledge.**
2.4. Expected learning outcomes at the level of the course (3-10 learning outcomes)	1. Spatial orientation in the field 2. Reading of the topographic maps in the field 3. Independently leading of the fieldbook 4. Teamwork 5. Construction of the geological map in the field	**1) Independently or in a group, adopt the ability of spatial orientation in the field using a topographic and geological map and keep a field diary.** **2) Recognise, describe and explain depositional processes in different ancient depositional environments based on sedimentary textures and structures.** **3) Apply suitable fieldwork methods in facies analysis.**

DESCRIPTION OF AMENDMENTS AND MODIFICATIONS TO UNDERGRADUATE, GRADUATE AND INTEGRATED UNDERGRADUATE AND GRADUATE STUDY PROGRAMMES

		4) Prepare, process, present and interpret sedimentological data from the available literature and outcrops, and design simple sedimentary models independently or in a group. **5) Recognise trends in depositional sequences and explain which factors may influence changes in depositional sequences.** **6) Apply acquired knowledge in the interpretation of sedimentary sequences, sedimentary basins and mineral deposits.** **7) Recognise the type of mineral deposit based on textures, mineral associations and relationship to the surrounding rocks.** **8) Sketch and explain the geological relationship between the mineral deposit and the surrounding rocks identified in the field.** **9) Suggest a model for the formation of a mineral deposit.**
2.5. Course content (syllabus)	1. Field introduction 2. Individual work in field and camp 3. Introduction to ore bodies structures 4. Introduction to structure of sedimentary rocks 5. Sedimentological logging	**1) Origin and development of the North Dalmatian foreland basin** **2) General characteristics of the Promina Beds in the North Dalmatian foreland basin** **3) Fundamentals of fieldwork; the use of geological maps, sedimentological logging, measurement of ripple indices** **4) Sedimentary features, depositional processes and depositional environment of the Dalmatian flysch unit** **5) Sedimentary features, depositional processes and depositional environment of the Korlat unit (olistoliths, megabeds, hyperpycnites)** **6) Sedimentary features, depositional processes and depositional environment of the Benkovac Stone unit (tempestites, trace fossils) and the Krka unit (deformation structures – slumps, seismites, load structures)** **7) Shallow-marine skeletal limestones, calciclastic shelf sediments, resedimentation products (slumps, debrites) and parasequences of the Novigrad unit** **8) Sedimentary features and depositional processes in Gilbert-type deltas and shoal-water deltas of the Karin unit** **9) Sedimentary features and depositional processes in alluvial environments**

DESCRIPTION OF AMENDMENTS AND MODIFICATIONS TO UNDERGRADUATE, GRADUATE AND INTEGRATED UNDERGRADUATE AND GRADUATE STUDY PROGRAMMES

<table>
<tr><td></td><td colspan="9"></td><td colspan="9">10) Sedimentary features of Foraminiferal Limestone
11) Features of hydrothermal mineral deposits – stratabound type of deposits
12) Features of hydrothermal mineral deposits – sedex and MVT types of deposits
13) Characteristics of weathering mineral deposits – karst bauxite and laterite
14) Characteristics of pegmatite mineral deposits
15) Writing the final report</td></tr>
<tr><td>2.6. Format of instruction:</td><td colspan="9">☐ lectures
☐ seminars and workshops
☐ exercises
☐ online in entirety
☐ partial e-learning
☒ field work
☐ independent assignments
☐ multimedia and the internet
☐ laboratory
☐ work with mentor
☐ (other)</td><td colspan="9">☐ lectures
☐ seminars and workshops
☐ exercises
☐ online in entirety
☐ partial e-learning
☒ field work
☒ independent assignments
☐ multimedia and the internet
☐ laboratory
☐ work with mentor
☐ (other)</td></tr>
<tr><td>2.7. Comments:</td><td colspan="9"></td><td colspan="9">A decrease in ECTS points from 7 to 2 is requested, and modification of the type of instruction (a change of number of exercise hours from 105 to 40).</td></tr>
<tr><td>2.8. Student obligations</td><td colspan="9">Independently create a geological map of a specific area, create a field diary and a detailed sedimentological column.</td><td colspan="9">Actively participate in field classes, keep a field diary, draw a detailed sedimentological log and write a final report.</td></tr>
<tr><td rowspan="5">2.9. Monitoring student work</td><td>Class attendance</td><td></td><td>NO</td><td>Research</td><td></td><td>NO</td><td>Oral exam</td><td></td><td>NO</td><td>Class attendance</td><td>YES</td><td></td><td>Research</td><td></td><td>NO</td><td>Oral exam</td><td></td><td>NO</td></tr>
<tr><td>Experimental work</td><td></td><td>NO</td><td>Report</td><td></td><td>NO</td><td>(other)</td><td></td><td>NO</td><td>Experimental work</td><td></td><td>NO</td><td>Report</td><td></td><td>NO</td><td>Written report</td><td>YES</td><td></td></tr>
<tr><td>Essay</td><td></td><td>NO</td><td>Seminar paper</td><td></td><td>NO</td><td>(other)</td><td></td><td>NO</td><td>Essay</td><td></td><td>NO</td><td>Seminar paper</td><td></td><td>NO</td><td>(other)</td><td></td><td>NO</td></tr>
<tr><td>Preliminary exam</td><td></td><td>NO</td><td>Practical work</td><td>YES</td><td></td><td>(other)</td><td></td><td>NO</td><td>Preliminary exam</td><td></td><td>NO</td><td>Practical work</td><td>YES</td><td></td><td>(other)</td><td></td><td>NO</td></tr>
<tr><td>Project</td><td></td><td>NO</td><td>Written exam</td><td></td><td>NO</td><td>ECTS (total)</td><td colspan="2">7</td><td>Project</td><td></td><td>NO</td><td>Written exam</td><td></td><td>NO</td><td>ECTS (total)</td><td colspan="2">2</td></tr>
<tr><td rowspan="2">2.10. Required literature (available in the library and/or via other media)</td><td colspan="3">Title</td><td colspan="2">Number of copies in the library</td><td colspan="2">Availability via other media</td><td colspan="3">Title</td><td colspan="2">Number of copies in the library</td><td colspan="2">Availability via other media</td></tr>
<tr><td colspan="3">Bahun, S. (1993): Geološko kartiranje</td><td colspan="2">YES</td><td colspan="2">NO</td><td colspan="3">Babić, Lj., Zupanič, J., Kurtanjek, D. (1995): Sharply-Topped Alluvial Gravel Sheets in the Palaeogene Promina</td><td colspan="2">NO</td><td colspan="2">YES</td></tr>
</table>

				***Basin (Dinarides, Croatia),* Geologia Croatica, 48/1, 33–48.**		
	Dimitrijević, M. (1978): *Geološko kartiranje*	YES	NO	**Babić, LJ., Zupanič, J. (2008*): Evolution of a river-fed foreland basin fill: The North Dalmatian flysch revisited (Eocene, Outer Dinarides),* Natura Croatica, 17/4, 357–374.**	**NO**	**YES**
	Freeman, T. (2005): *Procedures in field geology,* Blackwell.	YES	NO	**Ćosović, V., Mrinjek, E., Nemec, W., Španiček, J. and Terzić, K. (2018): Development of transient carbonate ramps in an evolving foreland basin. – Basin Research, 30, 746–765.**	**NO**	**YES**
	Compton, R.R. (1985): *Geology in the field,* John Wiley & Sons.	YES	NO	**Gobo, K., Mrinjek, E., Ćosović, V. (2020): *Mass-transport deposits and the onset of wedge-top basin development: an example from the Dinaric Foreland Basin, Croatia,* Journal of Sedimentary Research, 90, 1527–1548.**	**NO**	**YES**
				Mrinjek, E., Pencinger, V., Sremac, J., Lukšić, B. (2005): *The Benkovac Stone Member of the Promina Formation: A Late Eocene Succession of Storm-Dominated Shelf Deposits,* Geologia Croatica, 58/2, 163–184.	**NO**	**YES**
				Palinkaš, L., Borojević Šoštarić, S., Strmić Palinkaš, S., Prochaska, W., Spangenberg, J., Cuna, S., Šinkovec, B. (2010): *Permian–polysulphide-siderite-barite-haematite deposit Rude in Samoborska Gora Mts., Zagorje–Mid–Transdanubian zone of the Internal Dinarides,* Geologia Croatica, 63, 93–115.	**NO**	**YES**
2.11. Optional literature	Korbar et al. (2012): *Guidelines for the construction of Basic geological map of the Republic of Croatia 1:50 000*.			**Other scientific papers related to the topic and/or area where the field course is conducted.**		

DESCRIPTION OF AMENDMENTS AND MODIFICATIONS TO UNDERGRADUATE, GRADUATE AND INTEGRATED UNDERGRADUATE AND GRADUATE STUDY PROGRAMMES

Table 2B Description of the course that was amended and/or modified – Field course in Geology IIIC

1. COURSE DECRIPTION – GENERAL INFORMATION		
	Before the modification	**After the modification**
1.1. Course teacher	Assistant Professor Andrea Čobić, PhD, Assistant Professor Katarina Gobo, PhD, Assistant Professor Zoran Kovač, PhD, Associate Professor Borna Lužar-Oberiter, PhD	**Associate Professor Zoran Kovač, PhD, Associate Professor Martin Krkač, PhD**
1.2. Name of the course	Field Course in Geology IIIB	**Field Course in Geology IIIC**
1.3. Associate teachers		**Hrvoje Lukačić, mag. ing. geol.**
1.4. Study programme (undergraduate, graduate, integrated)	Undergraduate	Undergraduate
1.5. Status of the course	Mandatory	**Elective**
1.6. Year of the study	3rd	3rd
1.7. ECTS credits	7	**2**
1.8. Type of instruction (number of hours L + E + S + e-learning)	0 + 105 + 0 + 0	0 + **40** + 0 + 0
1.9. Expected enrolment in the course	25	25
1.10. Level of application of e-learning (level 1, 2, 3), percentage of online instruction (max. 20%)		**Level 1, up to 3 %**
2.1. Course objectives	Obtaining skills for construction of geological maps, applications of acquired knowledge on geology of mineral deposits and analyses and interpretation of facies.	**To acquaint students with basic methods of orientation in the field. Train students to recognize and interpret hydrogeological and engineering geological elements in the field, and to collect and record appropriate quantitative and qualitative field data.**
2.2. Course enrolment requirements and/or entry competences required for the course	Involvement in courses Geological Mapping II, Geology of Mineral Deposits and Analysis and interpretation of facies	**Enrolled courses Hydrogeology and Principles of Engineering Geology**
2.3. Learning outcomes at the level of the programme to which	Mastering the use of geological maps and skills to make new geological maps and interpretations of mineral deposits and sedimentary facies	**1) Select and use suitable geological methods and specific technologies in solving geological problems.**

the course contributes	GL_2) Knowledge and understanding of the essential features, processes, materials, history and the development of the Earth and life. GL_3) Basic knowledge and understanding of the key aspects and concepts of geology GL_6) Awareness and understanding of the temporal and spatial dimensions in Earth processes GL_8) Awareness of major geological paradigms, the extent of geological time and Plate Tectonics GL_9) Knowledge and understanding of the complex nature of interactions within the geosphere GL_11) Ability to create simple geological models GL_12) Some understanding of the complexity of geological problems and the feasibility of their solution GL_14) Basic ability in the formalisation and specification of problems whose solution involves the use of geological methods GL_15) Knowledge of appropriate solution patterns for geological problems GL_16) Basic ability to describe a solution at an abstract level GL_18) Ability to integrate field and laboratory evidence with theory following the sequence from observation to recognition, synthesis and modelling GL_19) Appreciation of issues concerning sample selection, accuracy, precision and uncertainty during collection, recording and analysis of data in the field and laboratory GL_21) Basic ability to become familiar with new geological methods and technologies GL_22) Basic ability to apply appropriate technology and use relevant methods	**2) Apply information technologies (IT) when processing and presenting data.** **3) Use geological maps, domestic and foreign literature and databases, as well as other sources of information.** **4) Conduct field research independently or in a group and collect, describe and classify geological samples.** **5) Identify problems related to sampling and data processing in field and laboratory research.** **6) Organise field and laboratory data and compare them with acquired professional knowledge.**
2.4. Expected learning outcomes at the level of the course (3-10 learning outcomes)	6. Spatial orientation in the field 7. Reading of the topographic maps in the field 8. Independently leading of the fieldbook 9. Teamwork 10. Construction of the geological map in the field	**1) Orientate in the field with the help of a map, compass and applications for field work;** **2) Keep systematized and clear notes in the form of a field diary and geological field map;** **3) Identify and describe different types of lithologies and structural relationships, as well as engineering geological properties of rocks and soils;**

DESCRIPTION OF AMENDMENTS AND MODIFICATIONS TO UNDERGRADUATE, GRADUATE AND INTEGRATED UNDERGRADUATE AND GRADUATE STUDY PROGRAMMES

<table>
<tr><td></td><td colspan="2"></td><td colspan="2">4) Identify and measure linear and planar structural elements on an outcrop;
5) Perform engineering geological classification of rock mass;
6) Recognize geomorphological processes that affect engineering geological conditions;
7) Measure the discharge of springs and stream flow;
8) Determine the physical and chemical parameters of water;
9) Write a report on field research results.</td></tr>
<tr><td>2.5. Course content (syllabus)</td><td colspan="2">1. Field introduction
2. Individual work in field and camp
3. Introduction to ore bodies structures
4. Introduction to structure of sedimentary rocks
5. Sedimentological logging</td><td colspan="2">1) Reading topographic maps and orientation in the field with the help of a map, compass and computer applications for field work.
2) Collecting notes in the form of a field diary and geological field map.
3) Identification of linear and planar structural elements.
4) Structural measurements of linear and planar structural elements with a geological compass.
5) Engineering geological description of rocks and soil.
6) Engineering geological classification of rock mass.
7) Recognition of geomorphological processes that affect engineering geological conditions.
8) Measuring the discharge of springs and stream flow.
9) Determination of physical and chemical parameters of water.
10) Writing a final report.</td></tr>
<tr><td>2.6. Format of instruction:</td><td>☐ lectures
☐ seminars and workshops
☐ exercises
☐ online in entirety
☐ partial e-learning
☒ field work</td><td>☐ independent assignments
☐ multimedia and the internet
☐ laboratory
☐ work with mentor
☐ (other)</td><td>☐ lectures
☐ seminars and workshops
☐ exercises
☐ online in entirety
☐ partial e-learning
☒ field work</td><td>☒ independent assignments
☐ multimedia and the internet
☐ laboratory
☐ work with mentor
☐ (other)</td></tr>
<tr><td>2.7. Comments:</td><td colspan="2"></td><td colspan="2">A split of the course Field Course in Geology IIIB into two courses is requested: mandatory Field Course in Geology IIIB and elective Field Course in Geology IIIC, which would have 2 ECTS credits and 40 hours of exercises. The number of ECTS credits and the hours of the two separate colleges are aligned with the course load and content.</td></tr>
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DESCRIPTION OF AMENDMENTS AND MODIFICATIONS TO UNDERGRADUATE, GRADUATE AND INTEGRATED UNDERGRADUATE AND GRADUATE STUDY PROGRAMMES

<table>
<tr><td>2.8. Student obligations</td><td colspan="12">Independently create a geological map of a specific area, create a field diary and a detailed sedimentological column.</td><td colspan="12">Attend and actively participate in classes. Keep a field diary and a field map independently or in a group, and create a simple geological map and final report.</td></tr>
<tr><td rowspan="6">2.9. Monitoring student work</td><td>Class attendance</td><td></td><td>NO</td><td>Research</td><td></td><td>NO</td><td>Oral exam</td><td></td><td>NO</td><td>Class attendance</td><td>YES</td><td></td><td>Research</td><td></td><td>NO</td><td>Oral exam</td><td></td><td>NO</td></tr>
<tr><td>Experimental work</td><td></td><td>NO</td><td>Report</td><td></td><td>NO</td><td>(other)</td><td></td><td>NO</td><td>Experimental work</td><td></td><td>NO</td><td>Report</td><td></td><td>NO</td><td>Written report</td><td>YES</td><td></td></tr>
<tr><td>Essay</td><td></td><td>NO</td><td>Seminar paper</td><td></td><td>NO</td><td>(other)</td><td></td><td>NO</td><td>Essay</td><td></td><td>NO</td><td>Seminar paper</td><td></td><td>NO</td><td>Field map</td><td>YES</td><td></td></tr>
<tr><td>Preliminary exam</td><td></td><td>NO</td><td>Practical work</td><td>YES</td><td></td><td>(other)</td><td></td><td>NO</td><td>Preliminary exam</td><td></td><td>NO</td><td>Practical work</td><td>YES</td><td></td><td>(other)</td><td></td><td>NO</td></tr>
<tr><td>Project</td><td></td><td>NO</td><td>Written exam</td><td></td><td>NO</td><td>ECTS (total)</td><td colspan="2">7</td><td>Project</td><td></td><td>NO</td><td>Written exam</td><td></td><td>NO</td><td>ECTS (total)</td><td colspan="2">2</td></tr>
<tr><td rowspan="8">2.10. Required literature (available in the library and/or via other media)</td><td colspan="3">Title</td><td colspan="3">Number of copies in the library</td><td colspan="3">Availability via other media</td><td colspan="4">Title</td><td colspan="3">Number of copies in the library</td><td colspan="3">Availability via other media</td></tr>
<tr><td colspan="3">Bahun, S. (1993): Geološko kartiranje</td><td colspan="3">YES</td><td colspan="3">NO</td><td colspan="4">Bačani, A. (2006): Hydrogeology I, University of Zagreb, Faculty of Mining, Geology and Petroleum Engineering, 198 p. (in Croatian).</td><td colspan="3">YES</td><td colspan="3">NO</td></tr>
<tr><td colspan="3">Dimitrijević, M. (1978): Geološko kartiranje</td><td colspan="3">YES</td><td colspan="3">NO</td><td colspan="4"></td><td colspan="3"></td><td colspan="3"></td></tr>
<tr><td colspan="3">Freeman, T. (2005): Procedures in field geology, Blackwell.</td><td colspan="3">YES</td><td colspan="3">NO</td><td colspan="4"></td><td colspan="3"></td><td colspan="3"></td></tr>
<tr><td colspan="3">Compton, R.R. (1985): Geology in the field, John Wiley & Sons.</td><td colspan="3">YES</td><td colspan="3">NO</td><td colspan="4"></td><td colspan="3"></td><td colspan="3"></td></tr>
<tr><td colspan="3"></td><td colspan="3"></td><td colspan="3"></td><td colspan="4"></td><td colspan="3"></td><td colspan="3"></td></tr>
<tr><td colspan="3"></td><td colspan="3"></td><td colspan="3"></td><td colspan="4"></td><td colspan="3"></td><td colspan="3"></td></tr>
<tr><td>2.11. Optional literature</td><td colspan="12">Korbar et al. (2012): Guidelines for the construction of Basic geological map of the Republic of Croatia 1:50 000.</td><td colspan="12">Domenico, P.A., F.W.Schwartz (1997): Physical and chemical hydrogeology, J. Willey & Sons</td></tr>
</table>

DESCRIPTION OF AMENDMENTS AND MODIFICATIONS TO UNDERGRADUATE, GRADUATE AND INTEGRATED UNDERGRADUATE AND GRADUATE STUDY PROGRAMMES

Table 2B Description of the course that was amended and/or modified – Quaternary Geology

1. COURSE DECRIPTION – GENERAL INFORMATION		
	Before the modification	**After the modification**
1.1. Course teacher	Associate Professor Aleksandar Mezga, PhD	Associate Professor Aleksandar Mezga, PhD
1.2. Name of the course	Quaternary Geology	Quaternary Geology
1.3. Associate teachers		
1.4. Study programme (undergraduate, graduate, integrated)	Undergraduate	Undergraduate
1.5. Status of the course	Elective	Elective
1.6. Year of the study	3rd	3rd
1.7. ECTS credits	3	3
1.8. Type of instruction (number of hours L + E + S + e-learning)	30 + 0 + 0 + 0	30 + 0 + **15** + 0
1.9. Expected enrolment in the course	20	20
1.10. Level of application of e-learning (level 1, 2, 3), percentage of online instruction (max. 20%)	Level 1, up to 3%	Level 1, up to 3 %
2.1. Course objectives	Recognition of the youngest deposits, their distribution and facies, flora and fauna in the Quaternary, human development	Recognition of the youngest deposits, their distribution and facies, flora and fauna in the Quaternary, human development
2.2. Course enrolment requirements and/or entry competences required for the course	Completed courses Historical Geology II and Sedimentary Petrology.	Completed courses Historical Geology II and Sedimentary Petrology.
2.3. Learning outcomes at the level of the programme to which the course contributes	Possibility of recognition and interpretation of Quaternary deposits; recognition and interpretation of paleoenvironment; systematic excavation and analysis of fossil sites	**1) Recognise and apply basic and specific knowledge related to the fundamental laws of natural science in the interpretation of geological processes.** **2) Identify basic geological processes and geological materials, and connect them with the development of life on Earth and Earth itself.**

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		3) Select and use suitable geological methods and specific technologies in solving geological problems. **4) Use geological maps, domestic and foreign literature and databases, as well as other sources of information.** **5) Identify problems related to sampling and data processing in field and laboratory research.**
2.4. Expected learning outcomes at the level of the course (3-10 learning outcomes)	Sampling of Quaternary deposits, recording of lithological columns; recognition of paleoclimatic relations, interpretation of findings of animal and plant origin	**1) Select and use suitable methods when sampling Quaternary deposits.** **2) Select and use suitable methods when recording lithological sections in Quaternary sediments.** **3) Recognize the paleoclimatic relations from the data obtained from Quaternary deposits.** **4) Select and use suitable paleontological methods and specific technologies when interpreting fossil finds.**
2.5. Course content (syllabus)	Quaternary Stratigraphy, Research methods, Depositional Environment, Causes of Climate change, Pleistocene megafauna, Development of human civilization, Quaternary in Croatia	1) Quaternary Stratigraphy 2) Research **and Dating methods** **3) Depositional Environment (glacial)** **4) Depositional Environment (alluvial)** **5) Depositional Environment (aeolian)** 6) Causes of Climate change **7) Glaciations** **8) Causes of Quaternary glaciations** **9) Ice Age in Europe** 10) Pleistocene megafauna 11) Development of human civilization 12) Quaternary in Croatia
2.6. Format of instruction:	☒ lectures ☐ seminars and workshops ☐ exercises ☐ online in entirety ☐ partial e-learning ☒ field work ☐ independent assignments ☐ multimedia and the internet ☐ laboratory ☐ work with mentor ☐ (other)	☒ lectures ☒ **seminars and workshops** ☐ exercises ☐ online in entirety ☐ partial e-learning ☐ **field work** ☐ independent assignments ☐ multimedia and the internet ☐ laboratory ☐ work with mentor ☐ (other)
2.7. Comments:		
2.8. Student obligations	Regular attendance of course	Regular attendance of course**; Seminar presentation**
2.9. Monitoring student work	Class attendance: YES ☐ NO ☐ Research: YES ☐ NO ☐ Oral exam: YES ☐ NO ☐	Class attendance: YES ☐ NO ☐ Research: YES ☐ NO ☐ Oral exam: YES ☐ NO ☐

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	Experimental work		NO	Report		NO	(other)		NO	Experimental work		NO	Report		NO	(other)		NO
	Essay		NO	Seminar paper		NO	(other)		NO	Essay		NO	Seminar paper	**YES**		(other)		NO
	Preliminary exam	YES		Practical work		NO	(other)		NO	Preliminary exam	YES		Practical work		NO	(other)		NO
	Project		NO	Written exam	YES		ECTS (total)	3		Project		NO	Written exam	YES		ECTS (total)	3	

	Title	**Number of copies in the library**	**Availability via other media**	**Title**	**Number of copies in the library**	**Availability via other media**
2.10. Required literature (available in the library and/or via other media)	Stepen, J., Peter, G. (1991): *Quaternary Sediments,* John Wiley & Sons, London	YES	NO	Stepen, J., Peter, G. (1991): *Quaternary Sediments,* John Wiley & Sons, London	YES	NO
	Nilsson, T. (1983): *The Pleistocene: Geology and Life in the Quaternary Ice Age,* Springer Verlag, Stuttgart	YES	NO	Nilsson, T. (1983): *The Pleistocene: Geology and Life in the Quaternary Ice Age,* Springer Verlag, Stuttgart	YES	NO
	Fagan, B. (2009): *The Complete Ice Age,* Thames & Hudson, London	YES	NO	Fagan, B. (2009): *The Complete Ice Age,* Thames & Hudson, London	YES	NO
	Lowe, J., Walker, M. (1997): *Reconstructing Quaternary Environments,* Prentice Hall, London	YES	NO	Lowe, J., Walker, M. (1997): *Reconstructing Quaternary Environments,* Prentice Hall, London	YES	NO
2.11. Optional literature	Scientific articles			Scientific articles		

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Table 2a Description of the new course– Software in Geology

1. COURSE DECRIPTION – GENERAL INFORMATION			
1.1. Course teacher	Full professor with tenure Dražen Balen, PhD; Assistant Professor Zorica Petrinec, PhD	1.6. Year of the study	3rd
1.2. Name of the course	Software in Geology	1.7. ECTS credits	3
1.3. Associate teachers		1.8. Type of instruction (number of hours L + S + E + e-learning)	15 + 30 + 0 + 0
1.4. Study programme (undergraduate, graduate, integrated)	Undergraduate	1.9. Expected enrolment in the course	12
1.5. Status of the course	Elective	1.10. Level of application of e-learning (level 1, 2, 3), percentage of online instruction (max. 20%)	Level 1, up to 5 %
2. COURSE DESCRIPTION			
2.1. Course objectives	Introduce students with applications of Python and R languages in geology. Acquisition of basic knowledge and the development of basic skills necessary for the understanding and analysis of simple codes, their development and modification.		
2.2. Enrolment requirements and/or entry competences required for the course	Completed course Introduction to Geographic Information Systems.		
2.3. Learning outcomes at the level of the programme to which the course contributes	3) Identify simple geological problems and suggest possible solutions. 5) Apply information technologies (IT) when processing and presenting data. 7) Use geological maps, domestic and foreign literature and databases, as well as other sources of information. 13) Design and generate simple geological models.		
2.4. Expected learning outcomes at the level of the course (3-10 learning outcomes)	1) Explain possible applications of programming languages in geology. 2) Explain the flowchart of an algorithm. 3) Use of variables and operators, functions and methods in Python and R. 4) Control the programme flow with loops and statements. 5) Define and call functions. 6) Create basic diagrams using functions implemented in the basic R language package. 7) Use modules and packages that come with the standard installation of Python and R installation. 8) Use the integrated development environment (IDLE; RStudio) to write code.		
2.5. Course content (syllabus)	1) Introduction to programming. Comparison of the Python and R languages. 2) Programming and algorithms. Flowcharts. 3-7) Basics of Python. IDLE environment. Use of variables. Managing workflows. Functions. Modules and packages in Python. Data structure in Python. 8) Examples of the use of Python.		

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	9-12) Basic syntax of the R language. RStudio. Basic types of data and their structure. Functions. Methods for visualising data. Descriptive statistics. 13) Examples of the use of R in geology.									
2.6. Format of instruction:	☒ lectures ☐ seminars and workshops ☒ exercises ☐ online in entirety ☐ partial e-learning ☐ field work			☐ independent assignments ☐ multimedia and the internet ☐ laboratory ☐ work with mentor ☐ (other)			2.7. Comments:			
2.8. Student obligations	Attending classes.									
2.9. Monitoring student work	Class attendance	YES		Research		NO	Oral exam	YES		
	Experimental work		NO	Report		NO	(other)			
	Essay		NO	Seminar paper		NO	(other)			
	Preliminary exam	YES		Practical work	YES		(other)			
	Project		NO	Written exam	YES		ECTS (total)	3		

2.10. Required literature (available in the library and/or via other media)	**Title**	**Number of copies in the library**	**Availability via other media**
	Peterelli, M. (2021): *Introduction to Python in Earth Science Data Analysis: From Descriptive statistics to Machine Learning,* Springer, 229 p.	NO	YES
	Janoušek, V., Moyen, J.-F., Martin, H., Erban, V., Farrow, C. (2016): *Geochemical Modelling of Igneous Processes – Principles and Recepies in R Language: Bringing the Power of R to a Geochemical Community,* Springer, 346 p.	NO	YES

2.11. Optional literature (name the title)	

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Table 3 Plan of the study programme according to the licence / license in the Directory of Study Programmes or certificate issued by the Ministry of Science and Education after reaccreditation or letter from the Committee for Quality Management of the University of Zagreb (L- lecture, S – seminar, E – exercises, F – field work)

***As needed, the table can be copied**

****As needed, rows can be added to the table.**

COURSE STATUS	COURSE CODE	COURSE NAME	I semester	TOTAL HOURS				ECTS
				L	S	E	F	
required	255007	Mathematics I	I	30	0	30	0	4
	36206	Chemistry I	I	30	0	30	0	5
	36199	General Mineralogy	I	45	0	45	0	7
	36200	Physical Geology	I	45	0	45	0	7
	36201	General Paleontology	I	45	0	45	0	7
	38079	Physical Education and Health Culture 1*	I	0	0	30	0	
		Required courses TOTAL:		195	0	195	0	30

COURSE STATUS	COURSE CODE	COURSE NAME	II semester	TOTAL HOURS				ECTS
				L	S	E	F	
required	255016	Mathematics II	II	30	0	30	0	4
	36207	Chemistry II	II	30	0	30	0	5
	36208	Physics	II	45	0	30	0	6
	36213	System of Mineralogy	II	45	0	45	0	7
	36209	Fundamentals of Biology	II	30	0	15	0	3
	36210	Field Course in Geology I	II	0	0	0	60	5
	38080	Physical Education and Health Culture 2*	II	0	0	30	0	
		Required courses TOTAL:		180	0	150	60	30

***** In accordance with the Statute of the University of Zagreb, the course of Physical Education and Health Culture is required for students of the 1st and 2nd year year of undergraduate study, but it is not included in the timetable nor are ECTS credits attributed to it.

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COURSE STATUS	COURSE CODE	COURSE NAME	III semester	TOTAL HOURS				ECTS
				L	S	E	F	
required	41025	Historical Geology I	III	45	0	30	0	6
	41026	Mineral Optics	III	30	0	60	0	5
	90435	Invertebrate Paleontology	III	30	0	15	0	4
	41035	Micropaleontology I	III	15	0	30	0	3
	41028	Geophysics	III	30	0	15	0	5
	41029	Principles of Elemental and Phase Analyses	III	30	0	30	0	5
	41030	Seminar I	III	0	30	0	0	2
	40849	Physical Education and Health Culture 3*	III	0	0	30	0	
		Required courses TOTAL:		180	30	180	0	30

COURSE STATUS	COURSE CODE	COURSE NAME	IV semester	TOTAL HOURS				ECTS
				L	S	E	F	
required	41031	Historical Geology II	IV	30	0	30	0	4
	41032	Igneous and Metamorphic Petrology	IV	45	0	45	0	7
	41033	Sedimentary Petrology	IV	45	0	45	0	7
	90436	Vertebrate Paleontology	IV	30	0	15	0	3
	41036	Seminar II	IV	0	15	0	0	2
	41037	Field Course in Geology II	IV	0	0	0	90	7
	40850	Physical Education and Health Culture 4*	IV	0	0	30	0	
		Required courses TOTAL:		150	15	135	90	30

***** In accordance with the Statute of the University of Zagreb, the course of Physical Education and Health Culture is required for students of the 1st and 2nd year year of undergraduate study, but it is not included in the timetable nor are ECTS credits attributed to it.

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COURSE STATUS	COURSE CODE	COURSE NAME	V semester	TOTAL HOURS				ECTS
				L	S	E	F	
required	63318	Geological Mapping I	V	15	0	90	0	6
	63320	Structural Geology and Tectonics	V	30	0	30	0	5
	63321	Software in Geology	V	30	0	30	0	5
	41041	Geochemistry	V	30	0	15	0	4
	41042	Hydrogeology	V	30	0	15	0	4
	63322	Field Course in Geology IIIA	V	0	0	0	30	2
		Required courses TOTAL:		145	0	180	30	26
elective	63324	Methods in Paleontology	V	15	0	30	0	4
	63325	Gemmology	V	30	0	15	0	4
	63327	Marine Geology	V	30	0	30	0	4
		Elective courses TOTAL:		15-30	0	15-30	0	4
elective outside compulsory core	213517	Internship	V	0	0	90	0	4
		Elective courses outside compulsory core TOTAL:		0	0	90		4

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COURSE STATUS	COURSE CODE	COURSE NAME	VI semester	TOTAL HOURS				ECTS
				L	S	E	F	
required	63319	Geological Mapping II	VI	15	0	30	0	3
	41043	Geology of Mineral Deposits	VI	45	0	15	0	5
	41044	Engineering Geology	VI	30	0	15	0	4
	71835	Analysis and Interpretation of Facies	VI	45	0	30	0	5
	41046	Seminar III (Final Seminar)	VI	0	30	0	0	2
	63323	Field Course in Geology IIIB	VI	0	0	0	105	7
		Required courses TOTAL:		135	30	90	105	26
elective	63328	Rock Microstructure	VI	0	0	45	0	4
	63329	Quaternary Geology	VI	30	0	0	0	4
	63330	Universal Stage Methods	VI	15	0	30	0	4
		Elective courses TOTAL:		0-30	0	0-45	0	4
elective outside compulsory core	213517	Internship	VI	0	0	90	0	4
		Elective courses outside compulsory core TOTAL:		0	0	90	0	4

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Table 4 Plan of the study programme after the amendments and modifications (L—lecture, S – seminar, E – Exercises, F – field work)

***As needed, the table can be copied**

****As needed, rows can be added to the table**

***** Enter in BOLD all that is modified or new in the study programme**

COURSE STATUS	COURSE CODE	COURSE NAME	I semester	TOTAL HOURS				ECTS
				L	S	E	F	
required	255007	Mathematics I	I	30	0	30	0	4
	36206	Chemistry I	I	30	0	30	0	5
	36209	**Fundamentals of Biology**	I	**30**	0	**15**	0	**4**
	36199	General Mineralogy	I	45	0	45	0	7
	36200	Physical Geology	I	45	0	45	0	7
		English Language I	I	**30**	0	0	0	**3**
	38079	Physical Education and Health Culture1*	I	0	0	30	0	
		Required courses TOTAL:		210	0	165	0	30

COURSE STATUS	COURSE CODE	COURSE NAME	II semester	TOTAL HOURS				ECTS
				L	S	E	F	
required	255016	Mathematics II	II	30	0	30	0	4
	36207	Chemistry II	II	30	0	30	0	5
	36208	Physics	II	45	0	30	0	6
	36201	**General Paleontology**	II	**45**	**15**	**30**	0	**6**
	36213	System of Mineralogy	II	45	0	45	0	**6**
	36210	Field Course in Geology I	II	0	0	0	60	**3**
	38080	Physical Education and Health Culture 2*	II	0	0	30	0	
		Required courses TOTAL:		195	15	165	60	30

* In accordance with the Statute of the University of Zagreb, the course of Physical Education and Health Culture is required for students of the 1st and 2nd year year of undergraduate study, but it is not included in the timetable nor are ECTS credits attributed to it.

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COURSE STATUS	COURSE CODE	COURSE NAME	III semester	TOTAL HOURS				ECTS
				L	S	E	F	
required	41025	Historical Geology I	III	**30**	0	30	0	**5**
	41026	Mineral Optics	III	30	0	60	0	**6**
	90435	Invertebrate Paleontology	III	30	0	**30**	0	4
	41032	**Igneous Petrology**	III	**30**	0	**30**	0	**4**
	41035	**Micropaleontology**	III	15	0	30	0	**4**
	41041	**Geochemistry**	III	**30**	0	**15**	0	**4**
	40849	Physical Education and Health Culture 3*	III	0	0	30	0	
		Required courses TOTAL:		165	0	180	0	27
elective		**English Language II**	III	**30**	0	0	0	**3**
		Basics of Scientific Work	III	**15**	**15**	**15**	0	**3**
		Elective courses TOTAL:		15-30	0-15	0-15	0	3

* In accordance with the Statute of the University of Zagreb, the teaching of Physical Education and Health Culture is required for students of the 1st and 2nd year year of undergraduate study, but it is not included in the timetable nor are ECTS credits attributed to it.

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COURSE STATUS	COURSE CODE	COURSE NAME	IV semester	TOTAL HOURS				ECTS
				L	S	E	F	
required	41031	Historical Geology II	IV	**45**	0	30	0	**5**
	41032	**Metamorphic Petrology**	IV	**30**	0	**30**	0	**4**
	41033	**Sedimentary Petrology**	IV	45	0	45	0	**5**
	90436	**Vertebrate Paleontology**	IV	30	0	15	0	**4**
	41028	**Geophysics**	IV	**30**	0	**15**	0	**4**
	41037	Field Course in Geology II	IV	0	0	0	90	**5**
	40850	Physical Education and Health Culture 4*	IV	0	0	30	0	
		Required courses TOTAL:		150	0	135	0	**27**
elective	41036	Seminar	IV	0	**30**	0	0	**3**
		Basics of Geomorphology	IV	**30**	0	**15**	0	**3**
		Elective courses TOTAL:		0-30	0-30	0-15	0	3

* In accordance with the Statute of the University of Zagreb, the course of Physical Education and Health Culture is required for students of the 1st and 2nd year year of undergraduate study, but it is not included in the timetable nor are ECTS credits attributed to it.

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COURSE STATUS	COURSE CODE	COURSE NAME	V semester	TOTAL HOURS				ECTS
				L	S	E	F	
required	63318	Geological Mapping	V	**30**	0	**45**	0	**5**
	63320	Structural Geology and Tectonics	V	30	0	30	0	5
	41029	**Principles of Elemental and Phase Analysis**	V	**30**	0	**30**	0	**5**
	63327	**Marine Geology**	V	**30**	0	**15**	0	**4**
		Required courses TOTAL:		120	0	120	0	19
elective	63324	Methods in Paleontology	V	15	0	30	0	**3**
		Basics of Scientific Work	V	**15**	**15**	**15**	0	**3**
		English Language II	V	**30**	0	0	0	**3**
	63321	**Introduction to Geographic Information Systems**	V	30	0	30	0	5
		Environmental Geochemistry	V	**30**	0	**15**	0	**3**
		Mineral Raw Materials	V	**30**	0	**15**	0	**3**
		Elective courses TOTAL:		60-90	0-15	45-75	0	11
elective outside the compulsory core	213517	Internship	V	0	0	90	0	4
		Elective courses outside the compulsory core TOTAL:		0	0	90	0	4

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COURSE STATUS	COURSE CODE	COURSE NAME	VI semester	TOTAL HOURS				ECTS
				L	S	E	F	
required	41043	Geology of Mineral deposits	VI	45	0	15	0	5
	71835	Sedimentary Facies Analysis	VI	45	0	30	0	5
	41046	**Bachelor Thesis**	VI	0	**60**	0	0	**4**
	63322	**Field Course in Geology IIIA**	VI	0	0	0	**40**	**2**
	63323	**Field Course in Geology IIIB**	VI	0	0	0	**40**	**2**
		Required courses TOTAL:		90	60	45	80	18
elective	63329	Quaternary Geology	VI	30	**15**	0	0	**3**
		Basics of Geomorphology	VI	**30**	0	**15**	0	**3**
		Software in Geology	VI	**15**	0	**30**	0	**3**
	41044	**Principles in Engineering Geology**	VI	30	0	**30**	0	4
	41042	**Hydrogeology**	VI	**30**	0	**15**	0	**3**
		Field Course in Geology IIIC	VI	0	0	0	40	**2**
		Elective courses TOTAL:		75-105	0-15	45-90	0-40	12
elective outside the compulsory core	213517	Internship	VI	0	0	90	0	4
		Elective courses outside the compulsory core TOTAL:		0	0	90	0	4