U N I V E R S I T Y O F S P L I T

FACULTY OF CHEMISTRY AND TECHNOLOGY

DETAILED PROPOSAL OF THE STUDY PROGRAMME

GRADUATE STUDY OF CHEMISTRY

Orientations:

Organic Chemistry and Biochemistry

Environmental Chemistry

SPLIT, 2016.

GENERAL INFORMATION OF HIGHER EDUCATION INSTITUTION

Name of higher education institution	Faculty of Chemistry and Technology
Address	Split, Ruđera Boškovića 35
Phone	++ 385 21 329 420
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E-mail	dekanat@ktf-split.hr
Internet address	www.ktf.unist.hr

GENERAL INFORMATION OF THE STUDY PROGRAMME

Name of the study programme	Graduate study of Chemistry		
Provider of the study programme	Faculty of Chemistry and Technology		
Other participants			
Type of study programme	Vocational study programme ☐	University study programme ☒	
Level of study programme	Undergraduate ☐	Graduate ☒	Integrated ☐
	Postgraduate ☐	Postgraduate specialist ☐	Graduate specialist ☐
Academic/vocational title earned at completion of study	Master of Chemistry		

1. INTRODUCTION

1.1. Reasons for starting the study programme

Chemistry permeating the entire modern society, are represented in all developed regions of the EU countries and, therefore, need to take an appropriate position in the Split-Dalmatia County and beyond through the activities of University education institutions.
Chemistry, as a fundamental field of natural sciences and one of the oldest scientific disciplines, has grown up on three mutually related contents: theory, synthesis and analysis. In the global development of contemporary society chemistry was and has remained an unavoidable widely applicable scientific field focusing on industry, environmental protection, pharmacy and nutrition. It is necessary to foster, promote and develop the educational programmes of chemistry at all levels for the purposes of continual extending of knowledge of chemistry and the realization of educational support for the future superstructure of graduate and postgraduate study programmes from other scientific fields like chemical engineering and technology, environmental protection, biology, pharmacy, medicine, agronomy, food technology, agronomy, forensics, etc.

1.2. Relationship with the local community (economy, entrepreneurship, civil society, etc.)

Possible partners outside the high school system who have so far expressed interest and established cooperation (some are teaching base of the Faculty and the University of Split), and planned employment of young people who have completed university undergraduate, graduate and post-graduate study program in chemistry are: companies from Dalmatia (eg. AD Plastik, Brodosplit, CEMEX, Cian), the entire Croatian (the pharmaceutical industry (eg., PLIVA Croatia, Adriatic galenic laboratory), the oil industry (INA), the food industry, cosmetics industry, paints and varnishes, the company dealing with the protection environment, etc.) and Bosnia and Herzegovina (eg. aluminum), institutes (eg, Institute for Adriatic Crops and karst Reclamation, Institute of Oceanography and Fisheries, Mediterranean Institute for life Sciences), educational institutions of different levels (high school, polytechnic) VIK, County Institute of public health, the Croatian army and police, various inspection services at the national and regional level, ect.

1.3. Compatibility with requirements of professional organizations

One of the basic preconditions for quality implementation of the proposed program is educational, professional and research cooperation of all relevant factors that may contribute to the process of training and education of students. Teachers who teach in the study Chemistry are members of various professional associations and bodies

in Croatia (Croatian Chemical Society, Association of Chemical Engineers Split, Croatian Society of Chemical Engineers, Parent Committee for the natural sciences, field chemistry, Regional scientific council for natural Science, Croatian Academy of Engineering, Croatian standards Institute, etc.) and abroad (eg. American Chemical Society).

1.4. Name possible partners outside the higher education system that expressed interest in the study programme

Some of the specialized industry places and laboratories, teaching bases and the so-called places with whom Faculty of Chemical Technology cooperates (usually for the purpose of maintaining the placement of students - practical and field work and the preparation of the final work of students) are: companies from Dalmatia (eg. AD Plastik, Brodosplit, CEMEX, Cian), the entire Croatian (pharmaceutical industry, oil industry, food industry, cosmetics industry, paints and varnishes, the company dealing with the protection of the environment, etc.) and Bosnia and Herzegovina (eg. aluminum) and others. Partners faculties and institutes are as follows: Ruder Boskovic, Institute for Adriatic Crops and karst Reclamation, Institute of Oceanography and Fisheries, Mediterranean Institute for life Sciences.

1.5. Financing

Graduate study program Chemistry financed as all other study programs at the Faculty of Chemical Technology in Split (earmarked funds MZOS).

1.6. Comparability of the study programme with other accredited programmes in higher education institutions in the Republic of Croatia and EU countries

In developing the curriculum of undergraduate study Chemistry analyzed the comparability with similar programs of university studies in the world, including comparable programs exist in the following institutions University of Maribor (http://www.fkkt.um.si/sl/node/1462), Maribor , Slovenia, University of Ljubljana (http://www.fkkt.uni-lj.si/sl/studij/), Ljubljana, Slovenia, Universite de Geneve (http://www.unige.ch/sciences/Enseignements/ProgrammeCours_en .html), Geneva, Switzerland, Universite de Provence (http://chimie-sciences.univ-amu.fr/master-chimie), Marseille, France, University of Oxford (https://www.ox.ac.uk / admissions / undergraduate / courses-listing / chemistry? WSSS = 1), Oxford, United Kingdom, etc.

1.7. Openness of the study programme to student mobility (horizontal, vertical in the Republic of Croatia, and international)

The study is organized through one semester courses, which is one of the important preconditions for mobility. Compliance programs Chemistry with similar studies in the Republic of Croatia and the EU allows mobility of students and teaching staff. Mobility

can be achieved through enrollment in certain courses in studies of other faculties, the whole semester at similar colleges or through the development of the final project.
The Faculty has signed the agreement for Erasmus mobility of teachers and students from the Universite Techniche Dresden, Dresden, Germany, Universita degli Studi di Cagliari, Cagliari, Italy, Universita di Trieste, Trieste, Italy, AGH University of Science ant Technology, Krakow, Polonia, Polytecnich institutes of Braganca, Braganca, Portugal, University of Maribor, Maribor, Slovenia, Polymer technology college, Maribor, Slovenia and others. Chemistry and technology in Split participate in multilateral cooperation with the possibilities of mobility of students and teachers across the Central European Exchange Program for University Studies (CEEPUS). Through this program, the cooperation with the following foreign institutions: 1) Faculty of Material Science and Ceramics, AGH University of Science and Technology, Krakow, Poland, 2) Institute für Analytische Chemie, Karl-Franzens-Universität, Graz, Austria, 3) department of Analytical Chemistry, Slovak University of Technology, Bratislava, Slovak Republic, 4) Institute of Analytical Chemistry, Faculty of Chemical Technology, University of Pardubice, Czech Republic, 5) Faculty of Chemistry and Chemical Engineering, University of Maribor, Slovenia.

1.8. Compatibility of the study programme with the University mission and the strategy of the proposer, as well as with the strategy statement of the network of higher education institutions

Program is aligned with the Strategy of Faculty of Chemistry and Technology, University of Split, and its mission and vision, but also the strategy of the University of Split.

1.9. Current experiences in equivalent or similar study programmes

Faculty of Cemistry and Technology in Split was founded in 1960. During the last period, the Faculty has made a mark in the scientific production of Croatian and is thus confirmed his college education and maturity level. After his scientific productivity has become a major research institution located outside the Croatian Zagreb. The Faculty of Medicine published a considerable number of scientific papers, of which a significant number covered by the scientific bases *Web of Science* and *Current Contents*.
University teaching activity Faculty since its foundation is based on two scientific fields: chemistry and chemical engineering, which belong to different scientific fields (natural and technical).
Undergraduate study program Chemistry grew out of the former 45-year-old teaching and research experience of the faculty. Teachers College for many years involved in the teaching of chemistry in other faculties and departments of the University of Split, as well as at other universities abroad.

2. DESCRIPTION OF THE STUDY PROGRAMME

2.1. General information

Scientific/artistic area of the study programme	Natural sciences
Duration of the study programme	2 years (4 semesters)
The minimum number of ECTS required for completion of study	120
Enrolment requirements and admission procedure	Completed aappropriate undergraduate study.

2.2. Learning outcomes of the study programme (name 15-30 learning outcomes)

Master of chemistry will be able to:

- demonstrate the understanding of major concepts in all five major disciplines of chemistry: analytical, biochemistry, inorganic, organic and physical

- employ critical thinking and scientific methods to design, carry out, record and analyze the results of chemical experiments

- demonstrate proficiency in the use of appropriate instrumentation to collect and record data from chemical experiments.

- demonstrate the ability to use computers for chemical simulation and computation

- employ modern library search tools to locate scientific information

- demonstrate proficiency in writing and speaking about chemistry topics in clear and concise manner to both chemists and non-chemists according to the professional standards

- work in diverse teams in both classroom and laboratory effectively

- communicate and collaborate with colleagues effectively and respectfully

- know and follow proper procedures and regulations for safe handling, use and disposal of chemicals

- demonstrate an awareness of the impact of chemistry on the environment, society and other cultures outside the scientific community

- contribute their own knowledge and experiences to their community and the broader society by participating in professional and/or community activities

- gain entry into professional schools, graduate programs, or the job market.

2.3. Employment possibilities

Graduates students can be employed by the aforementioned business entities with which the faculty cooperates, as well as in educational institutions, various inspection services at the national and regional leve, ect.

2.4. Possibilities of continuing studies at a higher level

At the Faculty of Chemistry and Technology are graduate study Chemistry and Chemical Technology, and besides opportunities to continue studying at the Faculty, graduates of university undergraduate study Chemistry can continue their studies at other universities at home and abroad, especially in the field of European Higher Education.

2.5. Name lover level studies of the proposer or other institutions that qualify for admission to the proposed study

Not applicable.

2.6. Structure of the study

Terms and method of studying at a university undergraduate degree in chemistry are based on the Regulations on the Study and Study System Chemical Technology that complies with the Rules of Study and Study System of the University of Split. For example, mention rules detailed provision requirements for enrollment in the next academic year, regular or compulsory exams and exam dates and the like.

2.7. Guiding and tutoring through the study system

At the Faculty of Chemistry and Technology there is a model teacher-mentor through which students can get help, advice and support. There is also a mentoring system when creating the final work.

2.8. List of courses that the student can take in other study programmes

For graduate study Chemistry students may choose electives for a small number of cases (eg, English, sports activities) from other studies at the University of Split in accordance with the rules of the University who may or may not enter the workload which yields a specific decision for each student.

2.9. List of courses offered in a foreign language as well (name which language)

Teaching at undergraduate level of Chemistry, generally will run in the Croatian language. Since the program there are objects which carries a possibility of realization of teaching in English, it is possible that in these courses as needed realizes teaching in English.

2.10. Criteria and conditions for transferring the ECTS credits

Criteria and transfer credits shall be prescribed by agreement between the institutions of higher education, the Rules on Study and Study System at the University of Split, the Statute of Chemical Technology in Split and the Regulations on Study and Study System of Chemical Technology in Split.

2.11. Completion of study

Final requirement for completion of study	Final thesis ☐ Diploma thesis ☒	Final exam ☐ Diploma exam ☒
Requirements for final/diploma thesis or final/diploma/exam	Requirements for final thesis are regulated by the *Ordinance on study programmes and course attendance system at the Faculty of Chemistry and Technology in Split.*	
Procedure of evaluation of final/diploma exam and evaluation and defence of final/diploma thesis	Procedure of evaluation of final/diploma exam is regulated by the *Ordinance on final thesis/diploma thesis at the Faculty of Chemistry and Technology in Split.*	

2.12. List of mandatory and elective courses

Organic Chemistry and Biochemistry

List of courses							
Year of study: 1st							
Semester: 1st							
STATUS	CODE	COURSE	HOURS IN SEMESTER				ECTS
			L	S	E	F	
Mandatory	KTH101	Physical chemistry of electrolyte solutions	30	15	30	0	7.5
	KTH210	Chemometrics	30	15	30	0	7,5
	KTH103	Quantum chemistry	30	15	0	0	5.0
	KTH104	Organic analysis	30	15	60	0	10.0
	Total		120	60	120	0	30.0

List of courses							
Year of study: 1st							
Semester: 2nd							
STATUS	CODE	COURSE	HOURS IN SEMESTER				ECTS
			L	S	E	F	
Mandatory	KTH105	Organic synthesis	30	15	60	0	10.0
	KTH106	Chemistry and technology of aromatic plants	30	15	30	0	6.5
	KTH107	Introduction to molecular biology	30	15	15	0	5.0
	KTC103	General microbiology	30	0	30	0	5.5
	KTH1S	Experimental seminar paper	0	75	0	0	3.0
	Total		120	120	135	0	30.0

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List of courses							
Year of study: 2nd							
Semester: 3rd							
STATUS	CODE	COURSE	HOURS IN SEMESTER				ECTS
			L	S	E	F	
Mandatory	KTH201	Flavour chemistry	30	15	30	0	7.5
	KTH212	Physical biochemistry	15	15	15	0	4.5
	KTH203	Biochemical engineering	30	15	30	0	7.5
	KTH204	Synthesis of biologically active compounds	30	0	45	0	7.5
	Total		105	45	180	0	27,0
Elective	KTH216	Microemulsions in applied chemistry	15	15	30	0	3
	KTH217	Selected chapters from biochemistry	30	15	0	0	3
	KTH218	Chemical sensors and biosensors	30	0	15	0	3
	The minimum amount of credit that must be obtained from elective courses is 3.						

List of courses							
Year of study: 2nd							
Semester: 4th							
STATUS	CODE	COURSE	HOURS IN SEMESTER				ECTS
			L	S	E	F	
Mandatory	KTHODR	Diploma Thesis					12.0
	Total						12.0
Elective	KTH205	Environmental menagment system	30	15	30	0	6.5
	KTH213	Naturally occuring polymeric materials	30	0	30	0	6.0
	KTH214	Colloid chemistry	30	15	30	0	6.0
	KTH215	Quality assurance and accreditation in laboratory practice	30	15	28	2	6.0
	KTI302	Chemistry of materials	30	15	30	0	6.0
	KTI104	Surface chemistry	30	15	30	0	6.0
	KTI101	Methods of separation and speciation	30	15	30	0	6.0
	KTH102	Physical methods of analysis	30	15	30	0	6,0
	KTH211	Analytical environmental chemistry	30	15	30	0	6.0
	KTC217	Energy and Development	30	0	0	0	2.0
	The minimum amount of credit that must be obtained from elective courses is 18.						

Environmental Chemistry

List of courses							
Year of study: 1st							
Semester: 1st							
STATUS	CODE	COURSE	SATI U SEMESTRU				ECTS
			P	S	V	T	
Mandatory	KTH101	Physical Chemistry of Electrolyte Solutions	30	15	30	0	7.5
	KTH210	Chemometrics	30	45	0	0	7,5
	KTH103	Quantum Chemistry	30	15	0	0	5.0
	KTH104	Organic Analysis	30	15	60	0	10.0
	Total		120	60	120	0	30.0

List of courses							
Year of study: 1st							
Semester: 2nd							
STATUS	CODE	COURSE	SATI U SEMESTRU				ECTS
			P	S	V	T	
Mandatory	KTH215	Quality Assurance and Accreditation in Laboratory Practice	30	15	28	2	6,5
	KTI102	Chemistry of Materials	30	15	30	0	6.5
	KTI103	Analytical Environmental Chemistry	30	15	45	0	7,5
	KTI104	Surface Chemistry	30	15	30	0	6,5
	KTI1S	Experimental seminar paper	0	75	0	0	3.0
	Total		120	135	135	0	30.0

List of courses							
Year of study: 2nd							
Semester: 3rd							
STATUS	KOD	COURSE	SATI U SEMESTRU				ECTS
			P	S	V	T	
Mandatory	KTI201	Chemistry of Sea	30	15	30	0	6.5
	KTI202	Atmospheric Chemistry	45	15	15	0	7.5
	KTI203	Soil Chemistry	30	15	30	0	6.5
	KTI204	Water Chemistry	30	15	30	0	6.5
	Total		135	60	105	0	27
Elective	KTH216	Microemulsions in applied chemistry	15	15	30	0	3
	KTH217	Selected chapters from biochemistry	30	15	0	0	3
	KTH218	Chemical sensors and biosensors	30	0	15	0	3
	The minimum amount of credit that must be obtained from elective courses is 3.						

List of courses							
Year of study: 2nd							
Semester: 4th							
STATUS	CODE	COURSE	SATI U SEMESTRU				ECTS
			P	S	V	T	
	KTIODR	Diploma Thesis					12
	Total						30.0
Elective	KTH205	Environmental Menagment System	30	15	30	0	6.0
	KTI207	Solid State Chemistry	30	15	30	0	6.0
	KTI205	Chemistry and Technology of Aromatic Plants	30	15	30	0	6.0
	KTI206	Chemical Ecology	30	15	30	0	6.0
	KTH102	Physical Methods of Analysis	30	15	30	0	6,0
	KTI208	Solid State Physics	30	15	30	0	6.0
	KTI209	Corrosion and Materials Protection	30	0	30	0	6.0
	KTI210	Mathematical Tools in Chemical Engineering	30	15	0	0	4.0
	KTC217	Energy and Development	30	0	0	0	2.0
	KTH214	Colloid Chemistry	30	15	30	0	6.0
	KTI101	Methods of Separation and Speciation	30	15	30	0	6.5
	The minimum amount of credit that must be obtained from elective courses is 18.						

2.13. Course description

Organic Chemistry and Biochemistry

Physical chemistry of electrolyte solutions

NAME OF THE COURSE	Physical chemistry of electrolyte solutions					
Code	KTH101	Year of study	1.			
Course teacher	PhD, Vesna Sokol, assistant prof.	Credits (ECTS)	7.5			
Associate teachers		Type of instruction (number of hours)	L	S	E	F
			30	15	30	
Status of the course	Mandatory	Percentage of application of e-learning				
COURSE DESCRIPTION						
Course objectives	The aim of the course is a systematic review and extension of basic knowledge of structural, thermodynamic and transport properties of electrolyte solutions derived from lectures in physical chemistry.					
Course enrolment requirements and entry competences required for the course						
Learning outcomes expected at the level of the course (4 to 10 learning outcomes)	Upon successful completion of the program, students will be able to: 1) explain the main characteristic whereby electrolytes are distinguished from other solutions, 2) apply the thermodynamic quantities for the treatment of equilibrium conditions, 3) explain the different conductivity chemical models, 4) understand the theoretical treatment of transport properties based on the interionic attraction theory of Debye and Huckel 5) independently determine the equilibrium constant for the reaction of ionic associations, 6) interpret the experimental and theoretical data.					
Course content broken down in detail by weekly class schedule (syllabus)	Lectures 1st week: Introduction. Classification of solvents and electrolytes. Non-electrostatic interactions. Triple-ion formation. 2nd week: Spectroscopic studies of association. Ionizing solvation reactions. Thermodynamic energy functions and their variables. The chemical potential of electrolytes in solutions. 3rd week: Partial molar quantities. Attractive potentials of spatially fixed ions and dipoles. Van der Waals potential. Ions and molecules in homogeneous dielectric media. 4th week: Dipole molecule in a homogeneous dielectric medium. Reaction field. Complete ion-ion interaction potentials in solutions. 5th week: Particle size parameters (solvent molecules, inorganic and organic ions). Ions and molecules in the gas phase, (gas phase equilibria of electrolytes, ion clustering by solvent molecules. Ion solvation in the liquid phase. Extrapolation methods and extrathermodynamic assumptions. 6th week: Examples of solvation studies. Diffusion (measuring methods, self-diffusion, coupled diffusion. 7th week: Charge transport. Single ion conductivities. Empirical investigation on					

<table>
<tr><td></td><td colspan="6">electrolyte conductivity. Viscosity. Dielectric polarization.
8th week: Static permittivity. Measurement of high-frequency permittivity. Phenomenological aspects. Relaxation processes of pure liquids and their mixtures.
9th week: Relaxation spectra of electrolyte solutions (solvent and ion pairs relaxation). Dielectric decrement. Solvent relaxation time. Distribution and correlation functions.
10th week: Chemical model at low electrolyte concentrations – lcCM. The mean force potential, the activity coefficient of the lcCM, the ion pair concept of the lcCM.
11th week: Properties of electrolyte solutions at the lcCM. Measurement of the solvent activity. Activity coefficients and osmotic coefficients.
12th week: Experimental osmotic coefficients. Fitting equations for osmotic and activity coefficient. Pitzer equations, extended lcCM equation. Partial molar enthalpy.
13th week: Chemical kinetics as a test for chemical models on the MM level. Primary kinetic salt effect.
14th week: Solvent effects. Transport equations on the lcCM level. Hydrodynamic ion-ion interactions.
15th week: Electrophoretic term of the conductivity equation. Limiting law of conductivity.

<u>Seminars</u>
Solving numerical problems.

<u>Laboratory exercises</u>
1. Molar conductivity of symmetrical electrolytes. 2. The chemical model of conductivity. 3. Thermodynamic quantities for the association reaction. 4. Determination of stability constants of chlorocadmium complexes in water by direct potentiometry. 5. Thermodynamic study of $CdCl_2$ in water from potential difference measurements. 6. Determination of limiting transference number for sodium ion from aqueous solutions of NaCl using potentiometry method.</td></tr>
<tr><td>Format of instruction</td><td colspan="3">xlectures
xseminars and workshops
xexercises
□on linein entirety
□partial e-learning
□field work</td><td colspan="3">xindependent assignments
xmultimedia
xlaboratory
□work with mentor
□ (other)</td></tr>
<tr><td>Studentresponsibilities</td><td colspan="6">Students are required to attend classes (lectures and seminars 80%, and laboratory exercises 100%) and actively participate in the teaching process. This will be recorded and evaluated in making a final assessment.</td></tr>
<tr><td rowspan="6">Screening student work(name the proportion of ECTS credits for eachactivity so that the total number of ECTS credits is equal to the ECTS value of the course)</td><td>Class attendance</td><td>3</td><td>Research</td><td></td><td>Practical training</td><td></td></tr>
<tr><td>Experimental work</td><td>1</td><td>Report</td><td></td><td>(Other)</td><td></td></tr>
<tr><td>Essay</td><td></td><td>Seminar essay</td><td>0.5</td><td>(Other)</td><td></td></tr>
<tr><td>Tests</td><td>1</td><td>Oral exam</td><td>1</td><td>(Other)</td><td></td></tr>
<tr><td>Written exam</td><td>1</td><td>Project</td><td></td><td>(Other)</td><td></td></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Grading and evaluating student work in class and at</td><td colspan="6">The course content is divided into two units that students take over partial exams or joining final exam at the end of the semester. The written exam is considered passed if students achieve at least 60%. The final grade is based on the evaluation</td></tr>
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<tr><td>the final exam</td><td colspan="3">of partial exams. Grades: <60% not satisfied, 60-69% successful (2), 70-79% good (3), 80-89% very good (4), 90-100% excellent (5)</td></tr>
<tr><td rowspan="9">Required literature (available in the library and via other media)</td><td>Title</td><td>Number of copies in the library</td><td>Availability via other media</td></tr>
<tr><td>J.M.G. Barthel, H. Krienke, W. Kunz, Physical Chemistry of Electrolyte Solutions, Modern Aspects, Steinkopff, Darmstadt, 1998.</td><td>1</td><td></td></tr>
<tr><td>R. A. Robinson, R.H. Stokes, Electrolyte Solutions, 2nd Revised Edition, Dover Publications, 2002.</td><td>2</td><td></td></tr>
<tr><td></td><td></td><td></td></tr>
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<tr><td></td><td></td><td></td></tr>
<tr><td>Optional literature (at the time of submission of study programme proposal)</td><td colspan="3">P. Atkins, J. de Paula, Atkins' Physical Chemistry, 8th Edition, Oxford University Press, Oxford 2006.</td></tr>
<tr><td>Quality assurance methods that ensure the acquisition of exit competences</td><td colspan="3">Quality of the teaching and learning, monitored at the level of the (1) teachers, accepting suggestions of students and colleagues, and (2) faculty, conducting surveys of students on teaching quality.</td></tr>
<tr><td>Other (as the proposer wishes to add)</td><td colspan="3"></td></tr>
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Chemometrics

<table>
<tr><td>COURSE NAME</td><td colspan="5">Chemometrics</td></tr>
<tr><td>Code</td><td>KTH210</td><td>Godina studija</td><td colspan="4">2nd</td></tr>
<tr><td>Course teacher</td><td>PhD, Ante Prkić, assistant prof.</td><td>Bodovna vrijednost (ECTS)</td><td colspan="4">7,5</td></tr>
<tr><td rowspan="2">Associate teachers</td><td rowspan="2"></td><td rowspan="2">Način izvođenja nastave (broj sati u semestru)</td><td>P</td><td>S</td><td>V</td><td>T</td></tr>
<tr><td>30</td><td>45</td><td></td><td></td></tr>
<tr><td>Status of the course</td><td>Mandatory</td><td>Postotak primjene e-učenja</td><td colspan="4"></td></tr>
<tr><td colspan="6">OPIS PREDMETA</td></tr>
<tr><td>Course objectives</td><td colspan="5">Introduce students to the importance of the use of mathematical and statistical methods for processing experimental data, conduct multi-variety data, and planning experiments. Allow them to work on computers and familiar with standard software packages (MS Excel, Wolfram Mathematica, MatLab, Statistica).</td></tr>
<tr><td>Course enrolment requirements and entry competences required for the course</td><td colspan="5">Completed appropriate undergraduate</td></tr>
<tr><td>Learning outcomes expected at the level of the course (4 to 10 learning outcomes)</td><td colspan="5">1. Define the data distribution.
2. Apply second statistical hypothesis tests in chemistry.
3. Use third method of exploration data on real chemical systems.
4. Know the fourth design an experimental procedure.
5. Put the methods of modeling and optimization, and extract the useful information to know.
6. Know calibrate the analytical system, process measurement signal in order to obtain useful information</td></tr>
<tr><td>Course content broken down in detail by weekly class schedule (syllabus)</td><td colspan="5">Week 1: Introduction to chemometrics. Types of experimental data. The relation between the experimental data, information and knowledge. Seminar: Basic statistical concepts in MS Excel
Week 2: Basic Statistics in chemometrics. Probability. The distribution of the data. Descriptive statistics. The accuracy and precision. Seminar: Basic statistical concepts in Wolfram Mathematica
Week 3: Tests hypotheses. Parametric tests. Significance tests - t-test, F-test, ANOVA test for normality of distribution. Seminar: Basic statistical concepts in Statistics
Week 4: The one-factor analysis of variance. Multi-factor analysis of variance. Seminar: Significance tests in MS Excel
Week 5: Experimental design and optimization. Seminar: Tests of significance in Wolfram Mathematica.
Week 6: The quality of analytical measurement - assessment of variability, comparative tests, measurement uncertainty. Seminar: Tests of significance in Statistics
Week 7: Regression analysis, least squares method: linear models, tests of significance of regression parameters. Seminar: Regression analysis in MS Excel
8th week: Exploratory Data Analysis. A complex pattern. Identifying the sample. Methods for identification of the sample with and without an external teacher. Rotation. Seminar: Regression analysis in Wolfram Mathematica.
Week 9: Principal Component Analysis. Covariance matrix. Eigenvalues and eigenvectors. The principles of reducing the number of dimensions. Seminar: Regression analysis in statistics.
10th week: Hierarchical cluster analysis. Distance and similarity. Single, full and centroid connections. Dendrograms. Seminar: Analysis of the main components in</td></tr>
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<tr><td></td><td colspan="6">Wolfram Mathematica
11th week: Classification. Linear and nonlinear model of classification. Method K-nearest neighbors. Method independent modeling class analogy. Seminar: Principal Component Analysis in Statistics
12th week: Signal processing. Signal detection, limit of detection, limit choices and limit of quantification. Scaling. Filling. Averaging. Filtering. Leveling. Multi-point sampling. Fourier transformation. Modulation signal. Derivatives signal. Decompression. Seminar: Fourier Transform in Wolfram Mathematica
13th week: Optimization. The functions of the evaluation criteria. Making decisions based on multiple criteria. Pareto optimality. Derringer function. Seminar: Fourier Transform in MatLab
14th week: Algorithms for optimization. Simplex. Genetic algorithms. Basic principles, purpose and usage examples. Seminar: Linear and nonlinear models of classification in Statistics
15th week: molecular modeling. Optimization of the structure. Calculation of descriptors. Linking the physical and chemical properties of the structural properties of the molecules. Seminar: Algorithms for optimization in Statistics</td></tr>
<tr><td>Format of instruction</td><td colspan="3">x Lectures
x Seminars and workshops
x Exercise
☐on line in its entirely
x Mixed e-learning
☐Fieldwork</td><td colspan="3">x Homework
x multimedia
☐laboratory
☐Mentoring
☐ (other)</td></tr>
<tr><td>Studentresponsibilities</td><td colspan="6"></td></tr>
<tr><td rowspan="5">Screening student work(name the proportion of ECTS credits for eachactivity so that the total number of ECTS credits is equal to the ECTS value of the course)</td><td>Class attendance</td><td>0.5</td><td>Exploration</td><td></td><td>Practical work</td><td>1.0</td></tr>
<tr><td>Experimental work</td><td></td><td>Report</td><td></td><td>(Other)</td><td></td></tr>
<tr><td>Essay</td><td></td><td>Seminar</td><td>1.5</td><td>(Other)</td><td></td></tr>
<tr><td>Tests</td><td></td><td>Oral examination</td><td>1.0</td><td>(Other)</td><td></td></tr>
<tr><td>Written exam</td><td>1.0</td><td>Project</td><td>1.0</td><td>(Other)</td><td></td></tr>
<tr><td>Grading and evaluating student work in class and at the final exam</td><td colspan="6">The entire examination can be applied over the two partial test of theoretical and seminar materials during the semester. Passing threshold is 60%. Each colloquium in the assessment accounts for 50%. Lectures presence of 80 to 100% is 10% marks. The examination periods there is a written, oral and written and oral examination. Passing threshold is 60%. Passing one partial test from any part (previous activity) is valid throughout the current academic year. Written exam has a share of 30% of oral and written with 60% and 10% verbal. Students who did not pass the exam by the partial tests take the exam through written, oral and written-oral examination in the regular examination periods. Passing threshold is 60% and the examination form to participate in the assessment with 50%.
Rating: 60% -69% - satisfactory, 70% -79% - a good 80% -89% -very good, 90% -100% - excellent.</td></tr>
<tr><td>Required literature (available in the library and via other</td><td colspan="3">Title</td><td>Number of copies in the library</td><td colspan="2">Accessible via other media</td></tr>
</table>

media)	1. Paul GemeprlineEd.Practical Guide to Chemometrics, 2nd Ed. CRC Press, Taylor & FrancisG roup, 2006, Boca Raton, USA, 2006.	1	
	2. Richard G. Brereton: Chemometrics Data Analysis for the Laboratory and Chemical Plant, John Wiley & Sons Ltd, West Sussex, UK, 2003	1	
	2. Peter C. Meier,Richard E. Zund, Statistical Methods in Analytical Chemistry, 2nd Ed. John Wiley & Sons Ltd, New York, USA, 2000.	1	
	3. Ivan Šošić, Primijenjena statistika, Školska knjiga, Zagreb, Hrvatska, 2004.	1	
Optional literature (at the time of submission of study programme proposal)			
Quality assurance methods that ensure the acquisition of exit competences	• Registration of the presence of students • Annual analysis of student • Student survey		
Other (as the proposer wishes to add)			

Quantum chemistry

<table>
<tr><td>COURSE NAME</td><td colspan="5">Quantum Chemistry</td></tr>
<tr><td>Course code</td><td>KTH103</td><td>Year of study</td><td colspan="3">1st</td></tr>
<tr><td>Course lecturer</td><td>PhD, Magdi Lučić Lavčević, associate prof.</td><td>Credits (ECTS)</td><td colspan="3">5.0</td></tr>
<tr><td rowspan="2">Assistants</td><td rowspan="2"></td><td rowspan="2">Type of instruction</td><td>L</td><td>S</td><td>E</td><td>F</td></tr>
<tr><td>30</td><td>15</td><td>0</td><td>0</td></tr>
<tr><td>Course status</td><td>Mandatory</td><td>Application of e-learning (percentage)</td><td colspan="3"></td></tr>
<tr><td colspan="6">COURSE DESCRIPTION</td></tr>
<tr><td>Course objectives</td><td colspan="5">Introducing the students to the principles of quantum theory and application of this theory to the topics of chemistry. Establishment of modern methodologies for the theoretical study of the structure and spectra of atoms and molecules, molecular dynamics and molecular interactions.</td></tr>
<tr><td>Course enrolment requirements and entry competences required for the course</td><td colspan="5">none</td></tr>
<tr><td>Learning outcomes expected at the level of the course (4 to 10 learning outcomes)</td><td colspan="5">- Understanding of the basic principles of quantum chemistry and its role in modern chemical research
- Knowledge of and ability to apply mathematical methods used in quantum chemistry
- Extended theoretical knowledge needed to fully understand the physics of atoms and molecules
- Ability to analyze the structure of molecules and their energy states
- Mastering modern methods of quantum chemistry at the level of operational knowledge acquisition for computing structure and spectra.
- Extended and an improved knowledge and understanding of interactions between molecules, the behavior of molecules in external fields and methodological approaches to research these phenomena
- Drawing conclusions about developments related molecules based on the analysis of experimental data
- The ability of using presented models (electronic structure of organic molecules; cages, clusters, nanomaterials and crystals; studies of polymers, proteins and drugs).</td></tr>
<tr><td>Course content broken down in detail by weekly class schedule (syllabus)</td><td colspan="5">Problems of the classical theory: stability and dimensions of atoms and molecules, photoelectric effect, black body radiation spectrum of the hydrogen atom, Bohr model of the atom. The old quantum theory. Quantum theory: the wave nature of particles, Schrodinger equation, spin, postulates. Particle in a box. Harmonic oscillator. Hydrogen atom, atomic orbitals. Spin. Multielectron atoms. Atomic spectra. Born-Oppenheimer approximation, Heitler-London's approach. Molecular orbitals. Correlation diagram. Hybridization. Huckel molecular orbitals. Electronic structure of crystals. Ligand field theory. The molecular spectra. Molecular mechanics. The interaction of molecules. The molecules in external fields. Application of presented models. Prediction of molecular properties.</td></tr>
<tr><td>Format of instruction</td><td colspan="2">X lectures
☐ seminars and workshops
☐ exercises
☐ on line in entirety
☐ partial e-learning</td><td colspan="3">☐ independent assignments
X multimedia
☐ laboratory
☐ work with mentor
X group and individual tutorials</td></tr>
</table>

<table>
<tr><td></td><td colspan="3">☐ field work</td><td colspan="3">X seminars</td></tr>
<tr><td>Student responsibilities</td><td colspan="6"></td></tr>
<tr><td rowspan="6">Screening student work (name the proportion of ECTS credits for each activity so that the total number of ECTS credits is equal to the ECTS value of the course)</td><td>Class attendance</td><td>1.0</td><td>Research</td><td></td><td>Practical training</td><td></td></tr>
<tr><td>Experimental work</td><td></td><td>Report</td><td></td><td>Pre-test preparation classes</td><td></td></tr>
<tr><td>Essay</td><td></td><td>Seminar essay</td><td>1.3</td><td>(Other)</td><td></td></tr>
<tr><td>Tests</td><td>1.4</td><td>Oral exam</td><td>1.3</td><td>(Other)</td><td></td></tr>
<tr><td>Written exam</td><td></td><td>Project</td><td></td><td>(Other)</td><td></td></tr>
<tr><td colspan="6"></td></tr>
<tr><td>Grading and evaluating student work in class and at the final exam</td><td colspan="6">During the semester, the final exam can be passed via midterm exams and seminar essays -calculations..
During the final exams period, the final exam shall be taken after presenting the seminar essays.
Grades: 55-64% - sufficient; 65-79% - good, 80-89% - very good; 90-100% - excellent.</td></tr>
<tr><td rowspan="4">Required literature (available in the library and via other media)</td><td colspan="3">Book title</td><td>Number of books in the library</td><td colspan="2">Available via other media</td></tr>
<tr><td colspan="3">Attila Szabo, Neil S. Ostlund, Modern Quantum Chemistry, Dover Publications, Mineola, NY, 1996;</td><td>1 coming soon</td><td colspan="2">-</td></tr>
<tr><td colspan="3">N. Trinajstić, Molekularne orbitale u kemiji, Suvremena kemija, Školska knjiga, Zagreb, 1974;</td><td>4</td><td colspan="2">-</td></tr>
<tr><td colspan="3"></td><td></td><td colspan="2">-</td></tr>
<tr><td>Optional literature</td><td colspan="6">W.G. Richards, J.A. Horstley, Ab initio Molecular Orbital Calculations for Chemists, Clarendon Press, Oxford, 1970.

A. Graovac, I. Gutman, N. Trinajstić, Topological Approach to the Chemistry of Conjugated Molecules, Springer, Berlin, 1977.</td></tr>
<tr><td>Quality assurance methods that ensure the acquisition of exit competences</td><td colspan="6">Quality assurance will be performed at three levels:
(1) University Level; (2) Faculty Level by Quality Control Committee; (3) Lecturer’s Level.</td></tr>
<tr><td>Other (as the proposer wishes to add)</td><td colspan="6"></td></tr>
</table>

Organic analysis

<table>
<tr><td colspan="2">NAME OF THE COURSE</td><td colspan="6">Organic Analysis</td></tr>
<tr><td>Code</td><td>KTH104</td><td>Year of study</td><td colspan="5">1</td></tr>
<tr><td>Course teacher</td><td>PhD, Ivica Blažević, assistant prof.</td><td>Credits (ECTS)</td><td colspan="5">10,0</td></tr>
<tr><td rowspan="2">Associate teachers</td><td rowspan="2"></td><td rowspan="2">Type of instruction (number of hours)</td><td>L</td><td>S</td><td>E</td><td colspan="2">F</td></tr>
<tr><td>30</td><td>15</td><td>60</td><td colspan="2">0</td></tr>
<tr><td>Status of the course</td><td>Mandatory</td><td>Percentage of application of e-learning</td><td colspan="5"></td></tr>
<tr><td colspan="8">COURSE DESCRIPTION</td></tr>
<tr><td>Course objectives</td><td colspan="7">The aim is to teach students the methods for isolation, purification and identification of diferent organic compounds classess by interpreting spectra obtained by modern spectroscopic techniques.</td></tr>
<tr><td>Course enrolment requirements and entry competences required for the course</td><td colspan="7">Organic chemistry</td></tr>
<tr><td>Learning outcomes expected at the level of the course (4 to 10 learning outcomes)</td><td colspan="7">After completing the course, the student will become familiarized with the major concepts of organic analysis, which includes:
• isolating different classes of organic compounds from complex mixtures
• selection of appropriate spectroscopic methods
• combining individual spectroscopic methods for structure elucidation;
• the use of spectroscopic methods to monitor the reaction process;
• application of acquired knowledge in research projects.</td></tr>
<tr><td>Course content broken down in detail by weekly class schedule (syllabus)</td><td colspan="7">➢ Lectures and seminars (L+S):
1. Classical methods of analysis. (12 + 4)
Biological samples. Reaction products. Commercial samples. Processing of the sample, isolation and concentration. Separation based on solubility, volatility, and the acid-base properties. Separation of the enantiomers. Polarimetry.
2. Chromatographic separation (TLC, GC, HPLC). (1 + 0)
3. Molecular formulas and what can be learned from them? (0.5 + 1)
Molecular formulas. Index of hydrogen deficiency. The rule of thirteen.
I. Partial exam (written, 1hour and 30 min)
4. Spectroscopy analysis methods. (0.5 + 0)
Spectroscopic techniques used in organic compound structure elucidation.
5. Mass spectrometry (MS). (3 + 1.5)
Theory, instrumentation, and techniques. Isotopic masses. Isotopic abundances, and high-resolution mass spectrometry (HRMS). Fragmentation in EIMS: influence of functional groups on fragmentation. Examples of different classes of organic compounds.
6. Ultraviolet and visible spectroscopy (UV/Vis) (3 + 1)
Electromagnetic spectra. The nature of electronic excitations. The origin of UV band structure. Principles of absorption spectroscopy. Presentation of spectra. Solvents. What is a chromophore. Effect of conjugation. What to look for in ultraviolet spectra. Examples of different classes of organic compounds.
7. Infrared spectroscopy (IR) (4 + 1.5)
Introduction, Theory, instrumentation, and sample preparation. C,H,O-containing functional groups. Effect of ring size, conjugation and electron-withdrawing groups. Examples of different classes of organic compounds.</td></tr>
</table>

<table>
<tr><td></td><td colspan="6">8. Nuclear magnetic resonance spectroscopy (NMR). (6 + 2)
Basic concepts. ^{1}H NMR Chemical shifts. Spin-Spin Coupling. Magnetic anizotropy. ^{13}C NMR Chemical shifts. Aromatic compounds – substituted benzene rings. Homotopic, enantiotopic, and diastereotopic systems. 2D NMR spectroscopy. Examples of different classes of organic compounds.
9. Combined structure problems (0 + 4)
II. Partial exam (written, 2 hours)
III. Partial exam (oral, 30 min)

➢ Laboratory exercises (E)
1. Separation of the water-insoluble mixtures. (5)
2. Separation of the water-soluble mixtures. (5)
3. Racemic mixture. Isolating the enantiomers of 1-phenylethylamine by fractional crystalization. Measuring the rotation of plane-polarized light by polarimeter. (7)
4. Tests for determination of the functional groups of separated compounds. (5)
5. Influence of inter- and intra-hydrogen bonds on melting point: Determination of the melting point on the aluminum block. (2)
6. UV/VIS absorption spectroscopy. Bathochromic shift: recording absorption spectra (benzene, aniline, phenol, benzoic acid, cinnamic acid, ferulic acid) and determination of auxochrome effect (-OH, -NH_2, - OCH_3) and conjugation on absorption maximum, λ_{max}. (4)
7. Recording absorption spectra and investigation of the influence of pH on the absorption bands of phenol and aniline. Study of the connection between molecular structure and absorption maxima: spectral acid-base indicators phenolphtalein and thymol blue in acidic and basic media. (4)
8. Hypsochromic effect of auxochrome on n→ π* transition of carbonyl group: Recording spectra of acetone and ethyl-acetate. (4)
9. Effect of solvent on the appearance of absorption band: the recording of UV spectra of phenol in ethanol and hexane. Influence of solvent on λ_{max} (impact on the n → π* transition): spectra of acetone in water, hexane and ethanol. (4)
10. IR spectroscopy. I part: recording the specta of isolated compounds (benzoic acid, sorbitol, thymol, aniline, 1-pentanol, acetone). (5)
11. IR spectroscopy, II part: recording spectra of selected solids and liquids. (5)
12. Analysis of obtained IR spectry and comparison by databases available on Internet (SDBS, NIST,...). Finding and analysing other available spectra in selected databases (MS, NMR,...). (5)
13. NMR spectroscopy. Analysis of NMR spectra (^{1}H i ^{13}C NMR) by using SPINWORKS software. (5)</td></tr>
<tr><td>Format of instruction</td><td colspan="3">X lectures
□ seminars and workshops
X exercises
□ on linein entirety
X partial e-learning
□ field work</td><td colspan="3">X independent assignments
X multimedia
X laboratory
□ work with mentor
X seminars</td></tr>
<tr><td>Student responsibilities</td><td colspan="6"></td></tr>
<tr><td rowspan="3">Screening student work(name the proportion of ECTS credits for each activity so that the total number of</td><td>Class attendance</td><td>1,5</td><td>Research</td><td>0</td><td>Practical training</td><td></td></tr>
<tr><td>Experimental work</td><td>1,5</td><td>Report</td><td>0</td><td>(Other)</td><td></td></tr>
<tr><td>Essay</td><td>0</td><td>Seminar essay</td><td>0</td><td>(Other)</td><td></td></tr>
</table>

ECTS credits is equal to the ECTS value of the course)	Tests	1,0	Oral exam	1,0	(Other)	
	Written exam	5,0	Project	0	(Other)	
Grading and evaluating student work in class and at the final exam	Course is divided into three sections that students take over 2 partial written and 1 oral exam or by final exam at the end of the semester. The student pass the exam if he/she achieves at least 60%. The final grade is based on the evaluation of partial exams and laboratory exercises. Scoring: <60% insufficient; 60-70% sufficient (2); 70-80% good (3); 80-90% very good (4); 90-100% excellent (5)					

	Title	**Number of copies in the library**	**Availability via other media**
Required literature (available in the library and via other media)	J. Mohan, *Organic Analytical Chemistry*, *Theory and Practice*, Alpha Science International Ltd., Pangbourne England, 2003.	1	ne
	D. L. Pavia, G. M. Lampman, G. S. Kriz, *Introduction to Spectroscopy, a guide for students of organic chemistry*, Harcourt College Publishers, USA, 2001.	1	ne
	E. Pretsch, J. Seibel, J. T. Clerc, *Tablice za određivanje strukture organskih spojeva spektroskopskim metodama*, SKTH/Kemija u industriji, 1982.	10	ne

Optional literature (at the time of submission of study programme proposal)	• E. Pretsch, P. Buehlmann, C. Affolter: "Structure Determination of Organic Compounds, Tables of Spectral data", Third Edition, Springer-Verlag Berlin Heidelberg, 2000. • H. Günzler, H.-U. Gremlich, *Uvod u infracrvenu spektroskopiju*, Školska knjiga Zagreb, 2006; • E. Breitmaier, *Structure Elucidation by NMR in Organic Chemistry*, Practical Guide, John Wiley & Sons, 2002; • I. Jerković, A. Radonić, *Praktikum iz organske kemije*, Udžbenici Sveučilišta u Splitu, Split, 2009.
Quality assurance methods that ensure the acquisition of exit competences	Quality assurance will be performed at three levels: (1) University Level; (2) Faculty Level by Quality Control Committee; (3) Lecturer's Level.
Other (as the proposer wishes to add)	

Organic synthesis

<table>
<tr><td colspan="2">NAME OF THE COURSE</td><td colspan="6">Organic Synthesis</td></tr>
<tr><td>Code</td><td>KTH105</td><td>Year of study</td><td colspan="5">1</td></tr>
<tr><td>Course teacher</td><td>PhD, Ivica Blažević, assistant prof.</td><td>Credits (ECTS)</td><td colspan="5">10,0</td></tr>
<tr><td rowspan="2">Associate teachers</td><td rowspan="2"></td><td rowspan="2">Type of instruction (number of hours)</td><td>L</td><td>S</td><td>E</td><td colspan="2">F</td></tr>
<tr><td>30</td><td>15</td><td>60</td><td colspan="2">0</td></tr>
<tr><td>Status of the course</td><td>Mandatory</td><td>Percentage of application of e-learning</td><td colspan="5"></td></tr>
<tr><td colspan="7">COURSE DESCRIPTION</td></tr>
<tr><td>Course objectives</td><td colspan="6">Acquisition of advanced knowledge of modern organic synthesis that involves studying practical laboratory techniques that are used in the synthesis of organic compounds.</td></tr>
<tr><td>Course enrolment requirements and entry competences required for the course</td><td colspan="6">Organic chemistry</td></tr>
<tr><td>Learning outcomes expected at the level of the course (4 to 10 learning outcomes)</td><td colspan="6">After completing the course, the student will become familiarized with the major concepts of organic analysis, which includes:
• developing strategy and planning the organic synthesis
• writing the mechanisms in organic synthesis
• analysis of examples of synthesis from published papers in order to sharpen student’s reasoning ability and critical thinking
• conclusion of the synthesis by using the retrosynthetic analysis
• mastering new laboratory procedures used in organic synthesis
• application of acquired knowledge in research projects.</td></tr>
<tr><td>Course content broken down in detail by weekly class schedule (syllabus)</td><td colspan="6">➢ Lectures and seminars (L+S):
1. Introduction. Target molecule. The carbon skeleton and functional groups. The main concepts in organic synthesis (mechanistic and retrosynthetic approach). Yields. Selectivity. (2 + 0)
2. Mechanistic approach. Writing mechanisms. Lewis structures, Lewis acids (LA), and bases (LB), LA / LB reactions. Resonance. Carbocation chemistry. Rearrangement. Problems. (3 + 1)
3. Electrophilic reactions to unsaturated carbon-carbon bonds, and aromatic compounds. LA / LB reaction of alcohols, alkenes, alkynes, and epoxides. LA / LB reactions that involving aromatic rings (electrophilic aromatic substitution reactions; Friedel-Crafts reaction and acylation reaction). Problems. (3 + 1)
4. Overview of the main nucleophilic substitution at saturated carbon. Formation of anions (the nucleophiles). Nucleophilic substitution (SN1, SN2). The stereochemistry and conformation of the synthesis. Elimination reaction (thermal and anti sin elimination reaction). Problems. (2 + 2)
5. Chemical reactivity and ring strain. Nucleophilic opening of the epoxide, episulphide and aziridine ring. The reaction with the nucleophile 3-membered species (and selinene halonium ions) and 3- and 4-membered cyclic esters (lactones) and cyclic amides (lactams). Problems. (2 + 1)
6. Nucleophilic addition reaction of aldehydes and ketones. Aldol condensation reaction. Michael addition reactions. The reaction of aldehydes or ketones with Wittig reagent. Problems. (2 + 2)
I. Partial exam (written, 2 hours)
7. Reaction of primary amines with aldehydes and ketones: (imine, Schiff base).</td></tr>
</table>

<table>
<tr><td></td><td colspan="6">Reactions of secondary amines with aldehydes and ketones: (enamines). Problems. (2 + 2)
8. Nucleophilic acyl substitution reactions. Problems. (2 + 1)
9. Retrosynthetic analysis. Fundamental concepts. Sinton and half-reactions. (3 + 0)
10. Strategy and planning. Convergent and linear synthesis of the target molecule. The aim of retrosynthetic analysis: the greatest simplification. Using the symmetry of the target molecule. The introduction of reactive functional groups in the final step of the synthesis. The introduction of functional groups to facilitate the formation of chemical bonds. Problems. (2 + 1)
11. Chemoselectivity and protecting groups. Protection of the carbonyl group to form a cyclic acetal. Protecting the alcohol group. Protection of the amine. Omitting the use of protecting groups. Reaction of one from two identical functional groups. Problems. (3 + 2)
12. Strategy of retrosynthetic analysis. Chemical transform - the guiding principle in retrosynthetic analysis. Diels-Alder cycloaddition as a target chemically transform. The strategy based on identifying the potential reactants, Building blocks and structural subunits (substructures). Topological strategy. Problems. (2 + 1)
13. Stereochemistry and conformation of the synthesis. Stereoselective synthesis and preparation of the optically pure compounds. The syntheses with isotopes of carbon and hydrogen. Examples of the synthesis of complex organic compounds. Problems. (2 + 1)
II. Partial exam (written, 1 hour 30 min)
III. Partial exam (oral, 30 min)
➢ Laboratory exercises (E)
1. Grignard reactions: Synthesis of phenyl acetic acid. (6)
2. Condensation reaction: Perkin synthesis: Synthesis of cinnamic acid. (6)
3. Addition reaction of carbonyl compounds: Claisen Schmidt condensation: Synthesis of dibenzylacetone. (6)
Multi-step synthesis: Benzoin - benzil - benzilic acid - phenytoin.
4. Synthesis of benzoin (condensation reaction) (6)
5. Synthesis of benzil (oxidation) (6)
6. Synthesis of benzilic acid (Molecular rearrangement - Benzilic rearrangement) (6)
7. Synthesis of phenytoin (Molecular rearrangement – Pinacol rearrangement) (6)
8. Cycloaddition reaction (Diels-Alder reaction): endo - exo selectivity. (6)
9. Beckmann rearrangement: Synthesis of ε-caprolactam. (6)
10. Confirmation of the compounds obtained by the synthesis. Determination of the UV and IR spectrum. (6)</td></tr>
<tr><td>Format of instruction</td><td colspan="3">X lectures
□ seminars and workshops
X exercises
□ on linein entirety
X partial e-learning
□ field work</td><td colspan="3">X independent assignments
X multimedia
X laboratory
□ work with mentor
X seminars</td></tr>
<tr><td>Student responsibilities</td><td colspan="6">Students are required to attend classes (lectures, seminars, exercises) and actively participate in the learning process. This will be recorded and evaluated in making the final grade.</td></tr>
<tr><td rowspan="2">Screening student work(name the proportion of ECTS credits for each</td><td>Class attendance</td><td>1,5</td><td>Research</td><td>0</td><td>Practical training</td><td></td></tr>
<tr><td>Experimental work</td><td>1,5</td><td>Report</td><td>0</td><td>(Other)</td><td></td></tr>
</table>

activity so that the total number of ECTS credits is equal to the ECTS value of the course)	Essay	0	Seminar essay	0	(Other)	
	Tests	1,0	Oral exam	1,0	(Other)	
	Written exam	5,0	Project	0	(Other)	

Grading and evaluating student work in class and at the final exam	Course is divided into two sections that students take over 2 partial written and 1 oral exam or by final exam at the end of the semester. The student pass the exam if he/she achieves at least 60%. The final grade is based on the evaluation of partial exams and laboratory exercises. Scoring: <60% insufficient; 60-70% sufficient (2); 70-80% good (3); 80-90% very good (4); 90-100% excellent (5)		
Required literature (available in the library and via other media)	**Title**	**Number of copies in the library**	**Availability via other media**
	W. C. Groutas. *Organic reactions mechanisms*. John Wiley & Sons Inc. USA, 2000.	1	Ne
	M. Mintas, S. Raić-Malić, N. Raos, *Načela dizajniranja lijekova*, Hinus, 2000.	2	Ne
	A. Vogel, Vogel's Textbook of Practical Organic Chemistry, 5th edit. Longman, London and New York 1996.	2	Ne
	S. Borčić, O. Kronja, Praktikum preparativne organske kemije, Školska knjiga Zagreb, 1991.	2	Ne
Optional literature (at the time of submission of study programme proposal)	• P. Wyatt, S. Warren, *Organic synthesis: Strategy and control*, John Wiley & Sons Ltd., England, 2007. • E. J.Corey, X. M. Cheng, The Logic of Chemical Synthesis, John Wiley & Sons, New York 1989. • Stanley H. Pine, Organska kemija, Školska knjiga, Zagreb, 1994. • E. Pretsch, P. Buhlmann, C. Affolter, *Structure Determination of Organic Compounds*, Springer, 2000;		
Quality assurance methods that ensure the acquisition of exit competences	Quality assurance will be performed at three levels: (1) University Level; (2) Faculty Level by Quality Control Committee; (3) Lecturer's Level.		
Other (as the proposer wishes to add)			

Chemistry and technology of aromatic plants

NAME OF THE COURSE	Chemistry and technology of aromatic plants					
Code	KTH106	Year of study	1.			
Course teacher	PhD, Igor Jerković, prof.	Credits (ECTS)	6.5			
Associate teachers	assistant	Type of instruction (number of hours)	L	S	E	F
			30	15	30	
Status of the course	obligatory	Percentage of application of e-learning				

COURSE DESCRIPTION	
Course objectives	Acquisition of basic knowledge on the chemistry and technology of aromatic plants, knowledge of the structures of organic compounds typical for the essential oils, their division and useful properties, knowledge on the biosynthesis of essential oils and methods of their isolation and identification of the oil components.
Course enrolment requirements and entry competences required for the course	-
Learning outcomes expected at the level of the course (4 to 10 learning outcomes)	After passing the course, students will be able to: • describe the basic concepts, essential oils, aromatic plants processing procedures, analyses of isolates obtained and typical use of essential oils • illustrate the ways of smell perception, the biosynthesis of terpenes and other compounds of essential oils, the basic division of terpenes • demonstrate basic procedures in the processing of aromatic plants, simple method for isolation of essential oils and aromatic extracts preparation • determine the appropriate method of analysis of derived isolates (basic physical and chemical values, the application of chromatographic and spectroscopic methods) • propose suitable procedures for the processing of aromatic plants, taking into account the fundamental principles of distillation and extraction procedures, the analysis of obtained isolates considering the possibility of artefacts formation as well as structural / biosynthetic relationship between the isolated compounds • choose the correct chemical approach for solving problems in the field of chemistry and technology of aromatic plants, starting from the acquired knowledge from organic chemistry and biochemistry
Course content broken down in detail by weekly class schedule (syllabus)	**Introduction to aromatic plants and essential oils** - definition, historical development of isolation and research of the essential oils. (3 hours); Natural, natural identical and synthetic essential oils; chemical structures of molecules and smell; activating receptors of smell: ion channels and G-proteins; essential oils in plants, plant formations for storage of the essential oils, chemotaxonomy and chemotypes of essential oils (3 hours). **Chemical composition of the essential oils**: terpenes, isoprene rule, division, cyclic and acyclic structures of mono- and sesquiterpenes; phenylpropanoic derivatives and other compounds in the essential oils (3 hours); Chirality and structures of terpenes; glycosidically bound volatile compounds; the basic structure of glycones and aglycones of the glycosides of volatile compounds; Biogenesis of 3-IPP via mevalonic acid; biogenesis 3-IPP over deoxyxylulose phosphate (DXP) (3

<table>
<tr><td></td><td colspan="6">hours); Biogenetic isoprene rule - the precursors of terpenes (GPP, FPP, GGPP); biogenesis semiterpenes, acyclic and cyclic mono-and sesquiterpenes. (3 hours)

Processing of aromatic plants: drying and storage; general overview of the methods of isolation and concentration of the essential oils; rate of distillation – hydrodiffusion; hydrolysis and decomposition of labile components of essential oils (3 hours); Hydrodistillation, water-vapour and steam distillation in the laboratory and in industry; comparison of water, water-steam and steam distillation (3 hours); Extraction with organic solvents, extraction with cold and hot fat; overview of the types of the obtained aromatic extracts; extraction with sub-and supercritical fluids (CO_2, H_2O); microwave extraction; simultaneous distillation-extraction (3 hours); Comparison of conventional and new extraction techniques; fractionation of the essential oils; basic physical and chemical values of the essential oils; chromatographic techniques in the analysis of essential oil (3 hours)

TLC and GC analysis of the essential oil, detectors (FID and MS), types of columns, sample preparation for the analysis of essential oil, retention time and the index, an overlap of peaks and fractionation of essential oils (pre-treatment) (3 hours); Modern chromatographic techniques in the analysis of essential oils: chiral GC, HSGC, MDGC, 2DGC; GC-MS; MS (SIM SCAN technique) - identification of terpenes and phenylpropane derivatives via MS (6 hours)

Overview of common essential oils - chemical composition and application (6 hours); the use of essential oils; mechanism of antibacterial and antioxidant activity; the structure of biologically active compounds of essential oils; undesirable effects of the essential oils (3 hours)</td></tr>
<tr><td>Format of instruction</td><td colspan="3">X lectures
X seminars and workshops
X exercises
□ on line in entirety
□ partial e-learning
□ field work</td><td colspan="3">□ independent assignments
□ multimedia
□ laboratory
□ work with mentor
☐(other)</td></tr>
<tr><td>Student responsibilities</td><td colspan="6">Students are required to attend classes (lectures and seminars) and actively participate in the teaching process, which will be evaluated in the final assessment by the weight coefficient of 5%.</td></tr>
<tr><td rowspan="6">Screening student work(name the proportion of ECTS credits for eachactivity so that the total number of ECTS credits is equal to the ECTS value of the course)</td><td>Class attendance</td><td>1</td><td>Research</td><td>0</td><td>Practical training</td><td>0</td></tr>
<tr><td>Experimental work</td><td>1</td><td>Report</td><td>0</td><td>(Other)</td><td></td></tr>
<tr><td>Essay</td><td>0</td><td>Seminar essay</td><td>0.5</td><td>(Other)</td><td></td></tr>
<tr><td>Tests</td><td>0</td><td>Oral exam</td><td>0</td><td>(Other)</td><td></td></tr>
<tr><td>Written exam</td><td>4</td><td>Project</td><td>0</td><td>(Other)</td><td></td></tr>
<tr><td></td><td colspan="5"></td></tr>
<tr><td>Grading and evaluating student work in class and at the final exam</td><td colspan="6">Students can take two partial tests during the lectures. If not pass partial tests, students will be evaluated by written exam. Rating at partial tests and the final examination is formed as follows: 51-60% sufficient (2); 61-75% good (3); 76-88% very good (4); 89-100% excellent (5). The total score is formed by summing all activities (for each activity % success multiply weigh coefficient): 5% x the presence and activity in lectures and seminars + 10% x success in experimental work + 43% x performance on the first test + 42% x performance on the second test.</td></tr>
</table>

	Title	Number of copies in the library	Availability via other media
Required literature (available in the library and via other media)	K. H. Basser, G. Buchbauer, Handbook of Essential Oils: Science, Technology and Application, CRC Press, 2010	1	no
	E. Guenther, The Essential Oils, vol. I: History – Origin in Plants – Production – Analysis, Jepson Press, 2008	1	no
	Igor Jerković, Predlošci za predavanja iz Kemije i tehnologije aromatičnog bilja, KTF, 2014.	0	yes (web page KTF)
Optional literature (at the time of submission of study programme proposal)	R. P. Adams, Identification of essential oils by gas chromatography/mass spectrometry, Allured Publishing Corporation, 2007 E. Guenther, The Essential Oils, vol. II-VI, van Nostrand Co, Princeton, 1964.		
Quality assurance methods that ensure the acquisition of exit competences	Monitoring of quality assurance will be performed at three levels: (1) University; (2) Faculty Level by Quality Control Committee; (3) Academic Level.		
Other (as the proposer wishes to add)			

Introduction to molecular biology

<table>
<tr><td colspan="2">NAME OF THE COURSE</td><td colspan="6">INTRODUCTION TO MOLECULAR BIOLOGY</td></tr>
<tr><td>Code</td><td>KTH107</td><td>Year of study</td><td colspan="5">1st</td></tr>
<tr><td>Course teacher</td><td>PhD, Olivera Politeo, associate prof.</td><td>Credits (ECTS)</td><td colspan="5">5 ECTS</td></tr>
<tr><td rowspan="2">Associate teachers</td><td rowspan="2">PhD, Tatjana Zemunik, prof.</td><td rowspan="2">Type of instruction (number of hours)</td><td>L</td><td>S</td><td>E</td><td>F</td></tr>
<tr><td>30</td><td>15</td><td>15</td><td>-</td></tr>
<tr><td>Status of the course</td><td>mandatory</td><td>Percentage of application of e-learning</td><td colspan="5">-</td></tr>
<tr><td colspan="7">COURSE DESCRIPTION</td></tr>
<tr><td>Course objectives</td><td colspan="6">Acquisition of basic knowledge and skills in the field of molecular biology.</td></tr>
<tr><td>Course enrolment requirements and entry competences required for the course</td><td colspan="6">-</td></tr>
<tr><td>Learning outcomes expected at the level of the course (4 to 10 learning outcomes)</td><td colspan="6">• Explain the structure of cells and the role of various cellular structures.
• Understanding the structure and role of chromosomal structures.
• Explain and understan the principle, the importance and mechanisms of DNA replication.
• Explain and understan the principle, the importance and mechanisms of transcription.
• Explain and understan the principle, the importance and mechanisms of translation.
• Understand the basic concepts and principles of recombinant technology.
• To know and learn the basic methods and techniques of molecular biology.</td></tr>
<tr><td>Course content broken down in detail by weekly class schedule (syllabus)</td><td colspan="6">LECTURES:
Introduction to molecular biology. Procaryotic and eucaryotic cell. (3) The structure and function of cells. Cell divisions. (3) The model organisms. (1) Nucleotids and nucleic acids. (1) The DNA organization into chromosomes. (1) DNA identification as the genetic material. (1) DNA replication. (2) DNA repair. (1) DNA recombination. (1) Telomeres. (1) Transcription. RNA processing. (2) Translation (2) Regulation of genes expression. (1) Glycosylation in the ER and Golgi Complex. (2) Folding and processing of proteins (2) Genetic engineering: Restriction endonuclease. Vectors. Cloning. (2) The basic methods and techniques of molecular biology. (2) Molecular medicine. Cancer. (2)

SEMINARS:
The life cycle of cells. (1) Mendel's laws. (1) DNA replication. (1) Transcription. (1) Translation. (1) Genomes. (1) Prions and prion diseases. (1) Genetically modified organisms. (1) Gene therapy (1) Cancer. (1)

EXERCISES:
DNA isolation. PCR. DNA electrophoresis.</td></tr>
<tr><td>Format of instruction</td><td colspan="2">□lectures
□seminars
□exercises</td><td colspan="4"></td></tr>
</table>

Student responsibilities	Class attendance, preparing seminar papers, attending to experimental work and taking the final exam.					
Screening student work*(name the proportion of ECTS credits for eachactivity so that the total number of ECTS credits is equal to the ECTS value of the course)*	Class attendance		Research		Practical training	
	Experimental work	1	Report		(Other)	
	Essay		Seminar essay	1	(Other)	
	Tests		Oral exam	1	(Other)	
	Written exam	2	Project		(Other)	
Grading and evaluating student work in class and at the final exam	Activity during attendance, presentation of seminar papers, experimental work and final exam.					

	Title	**Number of copies in the library**	**Availability via other media**
Required literature (available in the library and via other media)	G. M. Cooper, R. E. Hausman. Stanica. 5.izdanje. 2010.		
Optional literature (at the time of submission of study programme proposal)	B. Lewin. Genes IX. 2008. G. M. Malacinski. Essentials of Molecular Biology. Forth Edition, 2003. Lodish, Berg, Zipursky, Matsudaria, Batimore, Darnell. Molecular Cell Biology. Forth Edition, 2000		
Quality assurance methods that ensure the acquisition of exit competences	Monitoring of quality assurance will be performed at three levels: (1) University, (2) Faculty Level by Quality Control Committee, (3) Level of teachers.		
Other (as the proposer wishes to add)	-		

General microbiology

<table>
<tr><td>NAME OF THE COURSE</td><td colspan="5">General microbiology</td></tr>
<tr><td>Code</td><td>KTC103</td><td>Year of study</td><td colspan="4">1st</td></tr>
<tr><td>Course teacher</td><td>PhD, Mirjana Skočibušić, associate prof.</td><td>Credits (ECTS)</td><td colspan="4">5.5</td></tr>
<tr><td rowspan="2">Associate teachers</td><td rowspan="2">PhD, Maravić Ana, assistant</td><td rowspan="2">Type of instruction (number of hours)</td><td>L</td><td>S</td><td>E</td><td>F</td></tr>
<tr><td>30</td><td>0</td><td>30</td><td>0</td></tr>
<tr><td>Status of the course</td><td>Mandatory</td><td>Percentage of application of e-learning</td><td colspan="4">0</td></tr>
<tr><td colspan="6">COURSE DESCRIPTION</td></tr>
<tr><td>Course objectives</td><td colspan="5">This course is designed to give students understanding of basic concepts in microbiology including various microorganisms their physiology, morphology, genetics, ecology, pathogenicity and application used of laboratory methods and techniques in microbiological research.</td></tr>
<tr><td>Course enrolment requirements and entry competences required for the course</td><td colspan="5">No</td></tr>
<tr><td>Learning outcomes expected at the level of the course (4 to 10 learning outcomes)</td><td colspan="5">Students completing this course should be able to:
• better understanding of the evolutionary relationships between structure, diversity and replication of different groups of microorganisms.
• learn about genetic mechanisms of adaptation of prokaryotic microorganisms in a variety of environmental conditions.
• applied methods of physiological and biochemical tests for the identification of the different groups of microorganisms.
• identify the mechanisms of pathogenicity of microorganisms that cause diseases in humans and animals as well as the mechanisms used by the hosts to defend themselves against pathogens.
• determine the number of microorganisms in the sample and calculate the growth of microorganisms in controlled laboratory conditions.
•</td></tr>
<tr><td>Course content broken down in detail by weekly class schedule (syllabus)</td><td colspan="5">1. Introduction. Historical development of microbiology. (2 hours)
2. The distribution of microorganisms and their role in biogeochemical processes in nature. (2 hours)
3. Eukaryotes, Archaea and Bacteria; structure and function. Morphology, nomenclature and classification of microorganisms. (2 hours)
4. Basic structure and function of prokaryotic and eukaryotic cells. (2 hours)
5. Microbial genetics, genome organization, mobile genetic elements. (2 hours)
6. The growth of microorganisms and the basic growth factors, nutrients, temperature, oxygen, pH and osmotic pressure. (2 hours)
7. Metabolic activity of microorganisms. Identification of microorganisms using various physiological and biochemical tests. (2 hours)
8. Microorganisms and diseases, resistance, relationship microorganisms and host immune responses to infection. (2 hours)
9. Mechanisms of antimicrobial resistance to antibiotics and other chemical substances. (2 hours)
10. Basic morphological characteristics of fungi, yeasts and molds and their pathogenicity. Diseases caused by fungi, and their toxins. (2 hours)
11. Application of microorganisms in biotechnology. (2 hours)
12. Basic morphological characteristics and development cycles of parasites.
13. The role of microorganisms in the biodegradation of heavy metals, nitrate, and chlorinated hydrocarbons. (2 hours)</td></tr>
</table>

<table>
<tr><td></td><td colspan="6">14. Basic morphological characteristics of viruses, viroids and prions. Classification and nomenclature of viruses. Methods of studying properties of the viruses. (2 hours)
15. Control the growth of microorganisms by physical and chemical methods. (2 hours)
Lab topics will include: Techniques in aseptic conditions, methods of preparation and staining of various preparations. Isolation of pure cultures of microorganisms, preparation of culture media, culture and use of different methods of isolation and identification of bacteria. Basic macro and micromorphological characteristics and yeasts and molds. Cultivation of yeasts and molds on nutrient media, isolation and identification. The main morphological features of the parasite. Sampling and preparation of samples for identification of parasites. Mechanisms of antimicrobial resistance of bacteria to antibiotics and other chemical substances and to determine the sensitivity of microorganisms to antibiotics. Methods for determining the number of bacteria in different samples of food and water dilution method, the spectrophotometric method and membrane filtration.</td></tr>
<tr><td>Format of instruction</td><td colspan="3">☒ectures
☒seminars and workshops
☒exercises
☐on linein entirety
☐partial e-learning
☐field work</td><td colspan="3">☒independent assignments
☒multimedia
☒aboratory
☐work with mentor
☐(other)</td></tr>
<tr><td>Student responsibilities</td><td colspan="6">Admission to the lectures in the amount of at least 70% of the times scheduled. Completed all planned laboratory exercises and seminar essay.</td></tr>
<tr><td rowspan="6">Screening student work(name the proportion of ECTS credits for eachactivity so that the total number of ECTS credits is equal to the ECTS value of the course)</td><td>Class attendance</td><td>1.0</td><td>Research</td><td></td><td>Practical training</td><td></td></tr>
<tr><td>Experimental work</td><td>1.5</td><td>Report</td><td></td><td>(Other)</td><td></td></tr>
<tr><td>Essay</td><td></td><td>Seminar essay</td><td>0.5</td><td>(Other)</td><td></td></tr>
<tr><td>Tests</td><td></td><td>Oral exam</td><td>1.0</td><td>(Other)</td><td></td></tr>
<tr><td>Written exam</td><td>1.5</td><td>Project</td><td></td><td>(Other)</td><td></td></tr>
<tr><td colspan="6"></td></tr>
<tr><td>Grading and evaluating student work in class and at the final exam</td><td colspan="6">The final grade of the student is compiled from the combination of lecture, seminar, laboratory. Final course grade will be based on: Mid-term exam 30%; End of term exam 35%; Seminar 10%; Lab course 15%. Course grade will be based upon a percentage of total points obtained using the following scale: <60% insufficient; 60-70% sufficient (2); 70-80% good (3); 80-90% very good (4); 90-100% excellent (5).</td></tr>
<tr><td rowspan="4">Required literature (available in the library and 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">S. Duraković, S.Redžepović, Uvod u opću mikrobiologiju, Kugler, Zagreb, 2002.</td><td>5</td><td colspan="2"></td></tr>
<tr><td colspan="3">S. Kalenić, E. Mlinarić-Missoni i sur., Medicinska bakteriologija i mikologija, Merkur A.B.D., Zagreb, 2005.</td><td>5</td><td colspan="2"></td></tr>
<tr><td colspan="3">Z. Brudnjak, Medicinska virologija, Merkur A.B.D., Zagreb, 2002</td><td>5</td><td colspan="2"></td></tr>
<tr><td>Optional literature</td><td colspan="6">R.A. Harvey, P.C. Champe, B.D. Fisher, Microbiology, 2th ed., Lippincott, Williams</td></tr>
</table>

(at the time of submission of study programme proposal)	and Wilkins, Philadelphia, 2007. R.M. Patrick, S.R. Ken, A.P. Michael, Medical Microbiology, 5th ed. Elsevier/Mosby, Philadelphia, 2005.
Quality assurance methods that ensure the acquisition of exit competences	Quality assurance will be performed at different levels: Keeping records of his attendance; Annual performance analysis examination; Student surveys in order to evaluate teachers; Self-evaluation of teachers; Feedback from students who have already graduated from the relevance of content items.
Other (as the proposer wishes to add)	

Flavour chemistry

NAME OF THE COURSE	Flavour chemistry					
Code	KTH201	Year of study	2.			
Course teacher	PhD, Igor Jerković, prof.	Credits (ECTS)	7.5			
Associate teachers	assistant	Type of instruction (number of hours)	L	S	E	F
			30	15	30	
Status of the course	obligatory	Percentage of application of e-learning				

COURSE DESCRIPTION	
Course objectives	Acquisition of basic knowledge of flavour chemistry, understanding of the activation of receptors of smell and taste, knowledge of the structure of organic compounds of the typical flavours and their division, knowledge of the basic mechanisms of flavour formation and the flavour isolation methods.
Course enrolment requirements and entry competences required for the course	-
Learning outcomes expected at the level of the course (4 to 10 learning outcomes)	After passing the course, students will be able to: • describe the basic concepts, types of flavours, gustatory active molecule, legal regulations related to the flavour toxicological assessment and allowed concentration of biologically active substances • illustrate ways of flavour perception (smell and taste), the mechanisms of development of natural flavour, the division of flavouring substances based on the chemical structure • demonstrate basic procedures of flavour isolation from solid and liquid samples (headspace, volatile, semivolatile and nonvolatile substances) • identify appropriate mechanisms of flavour origin by specific patterns, particularly flavourings derived from carbohydrates and proteins and lipid oxidation flavours • propose appropriate methods of the sample processing taking into account the fundamental principles of distillation and extraction and the possibility of artefacts formation, structural linkage between aromatic compounds and suitable mechanism for their origin • choose the correct chemical approach to solving problems in the field of flavour chemistry, starting from the acquired knowledge in organic chemistry and biochemistry
Course content broken down in detail by weekly class schedule (syllabus)	**Introduction to the chemistry of flavour**. Classification of flavours. Natural, natural identical and artificial flavouring substances. Flavouring preparations. Thermal process flavourings. Smoke flavour. Blends of flavours. Review of the quality of flavour. (3 hours); A short overview of the development of flavour chemistry. **Legal regulations.** Natural, natural identical and artificial flavours – differences between the United States and the EU. New EU legislation. (3 hours); Croatian law on flavourings (NN) with emphasis on chemical specifications of flavours and maximum allowed values of biologically active substances in flavoured food. Croatian regulations on food additives (NN). Sweetening agents. Flavour enhancers. (3 hours) **The sense of smell.** Activating receptors of smell. **The sense of taste** - basic taste qualities. Activation of taste receptors. Example of aromagram. (3 hours); **Molecules with sensory effects** - examples of chemical structures: stinging molecules; molecules for cooling; strong, sharp molecules with heating and hot

<table>
<tr><td></td><td colspan="6">stimuli, the molecules with the contraction, shrinkage. The taste active molecule - examples of structures: sweeteners (nutritive, nonnutritious sweeteners, natural carbohydrates, noncarbohydrates, artificial sweeteners), salt, acid, bitter and umami substances (monosodium glutamate, inosine monophosphate). (3 hours)

The division of the flavour substances according to the chemical structure: flavouring substances I (C, H, O compounds: alcohols, phenols, acids, ketones, carotenoids, ionones and related compounds, hydrocarbons) - examples; the flavouring substances II (heterocyclic compounds with oxygen: oxiranes, furans, hydrofurans, pyrans and oxepines; heterocyclic compounds with nitrogen and/or sulphur) - examples, flavouring compounds III (compounds containing sulphur: thiols, thioethers, sulphides, heterocyclic compounds with sulphur) - examples (3 hours)

Mechanisms of flavour formation from the starting compounds. Terpenes (biosynthesis through MVA and DXP). Norisoprenoids (the mechanism of degradation of carotenoids). Phenylpropanoic derivatives (shikimate biogenetic pathway). (3 hours); Flavours derived from carbohydrates and proteins. Maillard reactions. Aldol reactions and retro-aldol reactions. Strecker degradations (cysteine, methionine). Comparison of Strecker degradation and Amadori rearrangement. (3 hours); Independent pathways occurrence of Strecker aldehydes. Amadori rearrangement by transamination and Strecker aldehydes formation by decarboxylation of α-oxocarboxylic acids. Strecker degradation and Amadori modelling in the development of flavour and colour. (3 hours); Heterocyclization (formation of furfural, hydroxymethylfurfural, 5-methyl-4-hydroxy-3(2H)-furanone, formyl furol, isomaltol, pyrazine, oxazole and thiazole). Flavours of thermal degradation of vitamin B1. (3 hours); Flavours of lipid oxidation. Triplet and singlet oxygen. Lipid oxidation by radicals (initiation, propagation and termination). Hydroperoxides and hydroperoxides breakup. Lactones. (3 hours); Non-radical lipid oxidation. Enzymatic lipid oxidation (lipoxygenation). Flavours caused by enzymatic reactions and by microorganisms (diacetyl from lactose, the flavours of onion and garlic). (3 hours)

Isolation methods for flavourings. Solvent extraction. Accelerated solvent extraction. Supercritical fluid extraction. The fractionation of the extracts. Concentration of the extracts. (3 hours); Distillation methods. Headspace isolation techniques (static, dynamic). Thermal desorption. Sorption techniques: headspace solid-phase microextraction; headspace extraction and extraction from the stirring stick. (3 hours)

Examples of chemical flavour profiles of selected food products: Honey flavour. Flavour of roasted coffee. Flavour of wine. Flavour of meat products. Cheese flavour. (3 hours)</td></tr>
<tr><td>Format of instruction</td><td colspan="3">X lectures
X seminars and workshops
X exercises
□ on linein entirety
□ partial e-learning
□ field work</td><td colspan="3">□ independent assignments
□ multimedia
□ laboratory
□ work with mentor
☐ (other)</td></tr>
<tr><td>Student responsibilities</td><td colspan="6">Students are required to attend classes (lectures and seminars) and actively participate in the teaching process, which will be evaluated in the final assessment by the weight coefficient of 5%.</td></tr>
<tr><td rowspan="3">Screening student work(name the proportion of ECTS credits for eachactivity so that the total number of</td><td>Class attendance</td><td>1</td><td>Research</td><td>0</td><td>Practical training</td><td>0</td></tr>
<tr><td>Experimental work</td><td>1</td><td>Report</td><td>0</td><td>(Other)</td><td></td></tr>
<tr><td>Essay</td><td>0</td><td>Seminar essay</td><td>0.5</td><td>(Other)</td><td></td></tr>
</table>

<table>
<tr><td rowspan="2">ECTS credits is equal to the ECTS value of the course)</td><td>Tests</td><td>0</td><td>Oral exam</td><td>0</td><td>(Other)</td><td></td></tr>
<tr><td>Written exam</td><td>5</td><td>Project</td><td>0</td><td>(Other)</td><td></td></tr>
<tr><td>Grading and evaluating student work in class and at the final exam</td><td colspan="6">Students can take two partial tests during the lectures. If not pass partial tests, students will be evaluated by written exam. Rating at partial tests and the final examination is formed as follows: 51-60% sufficient (2); 61-75% good (3); 76-88% very good (4); 89-100% excellent (5). The total score is formed by summing all activities (for each activity % success multiply weigh coefficient): 5% x the presence and activity in lectures and seminars + 10% x success in experimental work + 40% x performance on the first test + 45% x performance on the second test.</td></tr>
<tr><td rowspan="4">Required literature (available in the library and 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">Igor Jerković, Kemija aroma (recenzirana interna skripta), KTF-Split, 2011.</td><td>no</td><td>yes (web page KTF)</td></tr>
<tr><td colspan="3">D. Rowe, Chemistry and Technology of Flavours and Fragrances, Blackwell, 2005</td><td>2</td><td>no</td></tr>
<tr><td colspan="3">C. Fisher, T. R. Scott, Food Flavours: Biology and Chemistry, Royal Chemical Society, 1997</td><td>1</td><td>no</td></tr>
<tr><td>Optional literature (at the time of submission of study programme proposal)</td><td colspan="6">K. A. Smith, Advances in Flavours and Fragrances, Royal Chemical Society, 2001.</td></tr>
<tr><td>Quality assurance methods that ensure the acquisition of exit competences</td><td colspan="6">Monitoring of quality assurance will be performed at three levels: (1) University; (2) Faculty Level by Quality Control Committee; (3) Academic Level.</td></tr>
<tr><td>Other (as the proposer wishes to add)</td><td colspan="6"></td></tr>
</table>

Physical biochemistry

NAME OF THE COURSE	Physical biochemistry							
Code	KTH212	Year of study	2.					
Course teacher	PhD, Mladen Miloš, prof.	Credits (ECTS)	4,5					
Associate teachers	PhD, Vesela Torlak, assistant	Type of instruction (number of hours)	L	S	E	F		
			15	15	15			
Status of the course	Mandatory	Percentage of application of e-learning	33%					

COURSE DESCRIPTION

Course objectives	The goal of course Physical biochemistry is to connect and comprehensive understanding of the knowledge that students have gained learning courses of Physical Chemistry and Biochemistry.				
Course enrolment requirements and entry competences required for the course	Completed University undergraduate study: Chemistry				
Learning outcomes expected at the level of the course (4 to 10 learning outcomes)	Understanding (1) the application of thermodynamic principles in biochemistry, (2) the concept of chemical equilibrium, (3) chemical kinetics, (4) electrochemical processes, (5) bioenergetics and membrane processes and (6) the modern methods in biochemistry.				
Course content broken down in detail by weekly class schedule (syllabus)	Introduction, Concepts of Thermodynamics in Biochemistry (1 hour). Acids, bases and buffers in biochemistry (titration curves and electric charge, titration curves and protein isoelectric point) (1 hour). Thermodynamic concepts in biochemistry (open systems and the environment, work, energy and heat, the tool states, entropy and Gibbs free energy, thermodynamics and metabolism (2 hours). Bioenergetics and mebranski transfers (1 hour). Biochemical reactions and balance (1 hour) . Electrochemistry and biochemical processes (1 hour). interaction of protein - ligand (dissociation constant of singlet binding sites, dissociation constant of the inhibitor, the number of binding sites, thermodynamics of protein-ligand interactions (2 hours). Chemical kinetics of biochemical reactions, enzyme kinetics (2 hours) . Modern methods in biochemistry: Spectroscopic methods, methods of isolation, purification and identification of proteins, DNA molecules research methods, methods based on radioactivity (4 hours).				
Format of instruction	x lectures x seminars and workshops x exercises □ *on line*in entirety x partial e-learning □ field work		x independent assignments x multimedia x laboratory □ work with mentor □ (other)		
Studentresponsibilities					

Screening student work*(name the proportion of ECTS credits for eachactivity so that the total number of ECTS credits is*						
	Class attendance	2	Research		Practical training	
	Experimental work	1	Report		(Other)	
	Essay		Seminar essay	1	(Other)	
	Tests		Oral exam	0,5	(Other)	

equal to the ECTS value of the course)	Written exam		Project		(Other)	
Grading and evaluating student work in class and at the final exam	Activity during attendance, presentation of seminar papers in the form of a Power Point presentation and final oral exam.					

	Title	**Number of copies in the library**	**Availability via other media**
Required literature (available in the library and via other media)	Internal script Physical Biochemistry	-	Web page of Faculty
Optional literature (at the time of submission of study programme proposal)	- N. C. Price et al., Principles and problems in Physical chemistry for Biochemists, Third edition, Oxford University Press, Oxford, 2001. - P. Atkins and J. De Paula, Physical chemistry, 8ed, Oxford University Press, Oxford, 2006.		
Quality assurance methods that ensure the acquisition of exit competences	Monitoring of quality assurance will be performed at three levels: (1) University, (2) Faculty Level by Quality Control Committee, (3) Level of teachers.		
Other (as the proposer wishes to add)			

Biochemical engineering

<table>
<tr><td colspan="2">NAME OF THE COURSE</td><td colspan="5">Biochemical engineering</td></tr>
<tr><td>Code</td><td>KTH 203</td><td>Year of study</td><td colspan="4">2</td></tr>
<tr><td>Course teacher</td><td>PhD, Davor Rušić, prof.</td><td>Credits (ECTS)</td><td colspan="4">7.5</td></tr>
<tr><td rowspan="2">Associate teachers</td><td rowspan="2"></td><td rowspan="2">Type of instruction (number of hours)</td><td>L</td><td>S</td><td>E</td><td>F</td></tr>
<tr><td>30</td><td>15</td><td>30</td><td>0</td></tr>
<tr><td>Status of the course</td><td>Mandatory</td><td>Percentage of application of e-learning</td><td colspan="4"></td></tr>
<tr><td colspan="6">COURSE DESCRIPTION</td></tr>
<tr><td>Course objectives</td><td colspan="5">Mastering the engineering principles in chemistry, biochemistry and Mediterranean cultures</td></tr>
<tr><td>Course enrolment requirements and entry competences required for the course</td><td colspan="5">Chemistry, Biochemistry and Mathematics 1</td></tr>
<tr><td>Learning outcomes expected at the level of the course (4 to 10 learning outcomes)</td><td colspan="5">Student is expected to develop an ability to analyze an engineering aspects od Chemistry and Biochemistry</td></tr>
<tr><td>Course content broken down in detail by weekly class schedule (syllabus)</td><td colspan="5">Week 1: Definition of areas of biochemical engineering, biochemical engineering significance, connections with other areas of science.
Week 2: The concept of biological systems.
Week 3: Features of engineering fermentation processes.
Week 4: Features of engineering enzymatic processes.
Week 5: Field of the preparation of the substrate.
Week 6: Preparing for the test and systematization of presented lectures
Week 7: First test
Week 8: Area of bioconversion (introduction)
Week 9: The bioreactor as space unfolding biochemical reactions, types of reactors, reactor construction, aerated systems.
Week 10: Bioreaction kinetics (reaction kinetics concept, the influence of product and substrate, thermodynamics of the reaction, biocatalysis)
Week 11: The conditions in the bioreactor (sterility of the bioreactor system, the mode of reaction, the retention of biomass in the reactor, mass transfer, heat transfer, rheology and mechanical strength of the biological material)
Week 12: Design and analysis of bioreactors.
Week 13: Important biotechnological processes in idustry
Week 14: Preparation for second test.
Week 15: Second test</td></tr>
<tr><td>Format of instruction</td><td colspan="2">x lectures
☐seminars and workshops
☐exercises
☐*on line* in entirety
☐partial e-learning
☐field work</td><td colspan="3">☐ndependent assignments
☐multimedia
☐aboratory
☐work with mentor
☐ (other)</td></tr>
</table>

<table>
<tr><td>Student responsibilities</td><td colspan="6">Regular attendance and active participation at lectures, seminars and exercises.</td></tr>
<tr><td rowspan="6">Screening student work(name the proportion of ECTS credits for eachactivity so that the total number of ECTS credits is equal to the ECTS value of the course)</td><td>Class attendance</td><td>2.0</td><td>Research</td><td></td><td>Practical training</td><td>1.5</td></tr>
<tr><td>Experimental work</td><td></td><td>Report</td><td></td><td>Seminars</td><td>1.0</td></tr>
<tr><td>Essay</td><td></td><td>Seminar essay</td><td></td><td>(Other)</td><td></td></tr>
<tr><td>Tests</td><td>0.5</td><td>Oral exam</td><td>1.5</td><td>(Other)</td><td></td></tr>
<tr><td>Written exam</td><td>1.0</td><td>Project</td><td></td><td>(Other)</td><td></td></tr>
<tr><td colspan="6"></td></tr>
<tr><td>Grading and evaluating student work in class and at the final exam</td><td colspan="6">A student can pass a part or the entire exam by taking two partial tests during the semester. Students who do not pass the partial exams have to take an exam in the regular examination term. During the examination terms students take written and oral exam.
Scoring: <55% insufficient;55-66% sufficient (2); 67-79% good (3); 80-92% very good (4); 93-100% excellent (5)</td></tr>
<tr><td rowspan="7">Required literature (available in the library and 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">Z.Gomzi, Kemijski reaktori, Hinus, Zagreb 1977</td><td>10</td><td colspan="2"></td></tr>
<tr><td colspan="3"></td><td></td><td colspan="2"></td></tr>
<tr><td colspan="3"></td><td></td><td colspan="2"></td></tr>
<tr><td colspan="3"></td><td></td><td colspan="2"></td></tr>
<tr><td colspan="3"></td><td></td><td colspan="2"></td></tr>
<tr><td colspan="3"></td><td></td><td colspan="2"></td></tr>
<tr><td>Optional literature (at the time of submission of study programme proposal)</td><td colspan="6">E.Bailey,D.F.Ollis,Biochemical Engineering Fundamentals,McGraw-Hill.1986.
N.F.Millis, Biochemical Engineering ,Academic Press, N,Y.1978.</td></tr>
<tr><td>Quality assurance methods that ensure the acquisition of exit competences</td><td colspan="6">Quality assurance methods that ensure the acquisition of exit competences:
Quality of the teaching and learning, monitored at the level of the
(1) teachers, accepting suggestions of students and colleagues, and
(2) faculty, conducting surveys of students on teaching quality.</td></tr>
<tr><td>Other (as the proposer wishes to add)</td><td colspan="6"></td></tr>
</table>

Synthesis of biologically active compounds

NAME OF THE COURSE	Synthesis of Biologically Active Compounds					
Code	KTH 204	Year of study	2.			
Course teacher	PhD, Ani Radonić, associate prof.	Credits (ECTS)	7.5			
Associate teachers		Type of instruction (number of hours)	L	S	E	F
			30	0	45	
Status of the course	Mandatory	Percentage of application of e-learning	-			
COURSE DESCRIPTION						
Course objectives	Acquisition of basic knowledge about selected classes of biologically active compounds, with emphasis on their chemistry, i.e. structural characteristics that causes biological activity and thereby application in pharmacy and medicine.					
Course enrolment requirements and entry competences required for the course	-					
Learning outcomes expected at the level of the course (4 to 10 learning outcomes)	After passing the exam students will be able to: - specify the most important classes of biologically active compounds and the most important representatives of each class - recognize and give name to some, important biologically active compounds based on their structural formula and classify them in the appropriate class based on structural features and/or biological activity - present by structural formula the most important biologically active compounds - connect biological activity and chemical structure (structure-activity relationship) of important biologically active compounds - describe briefly synthesis of selected biologically active compounds - specify significance and application of important biologically active compounds - perform independently laboratory exercises according to laboratory procedures - perform independently synthesis, isolation and purification of biologically active compounds as well as their characterization					
Course content broken down in detail by weekly class schedule (syllabus)	**Lectures (2 hours weekly):** 1st week: Introduction to course (course content, students responsibilities, terms and conditions for passing exam). Biologically active compounds – definition. Chirality and biological activity. Natural bioactive compounds. Biological properties of chiral compounds. 2nd week: Methods for preparation of *enantiomerically pure compounds. Synthetic methods* for preparation of *enantiomerically pure compounds (biotechnological method of synthesis, stereoselective or asymmetric synthesis).* 3th week: Synthesis and semisynthesis of selected steroids. Female seks hormones. Estrogens. Progestins. Male seks hormones. 4th week: Synthesis of selected alkaloids. Morphine and morphine derivatives. 5th week: Semisynthetic morphine derivatives. Sympathomimetic drugs. Adrenaline. Ephedrine. 6th week: Nonsteroidal anti-inflammatory drugs. Salycilic acid derivatives. Propionic acid derivatives. Arylacetic acid derivatives. *p*-Aminophenol derivatives. 7th week: Sulfonamides. Sulfonylureas. 8th week: Barbiturates. Benzodiazepines.					

<table>
<tr><td></td><td colspan="6">9th week: Anesthetics. General anesthetics. Inhalational anesthetic. Intravenous anesthetic.
10th week: Local anesthetic. Ester type local anesthetic of ester type. Amide type local anesthetic.
11th week: Cardiovascular drugs. Vasodilators. β-Blockers.
12th week: Calcium channel blockers. ACE inhibitors.
13th week: Antibiotics – definition, classification, mechanism of action. β-lactam antibiotics. Penicillins.
14th week: Macrolides. Tetracyclines.
15th week: Synthesis of selected vitamins. Water-soluble vitamins. Fat-soluble vitamins.

Exercises (3 hours weekly joined together in 8 lab periods):
1. Sulfonamides. Sulfanilamide synthesis. (2 lab periods)
2. Nonsteroidal anti-inflammatory drugs. Acetysalicylic acid synthesis. (1 lab period)
3. Vitamins. Nicotinic acid synthesis. (2 lab periods)
4. Barbiturates. Barbituric acid synthesis. (2 lab periods)
5. Characterization of synthesized compounds. UV/VIS and FT-IR spectroscopy. Recording and interpretation of spectra. (1 lab period)</td></tr>
<tr><td>Format of instruction</td><td colspan="3">X lectures
□seminars and workshops
X exercises
□on linein entirety
□partial e-learning
□field work</td><td colspan="3">□independent assignments
X multimedia
X laboratory
□work with mentor
□ (other)</td></tr>
<tr><td>Studentresponsibilities</td><td colspan="6">Students are required to attend lectures in the amount of at least 80% of the times scheduled and complete all laboratory exercises (100% attendance). Active participation in teaching process will be also evaluated in the final score.</td></tr>
<tr><td rowspan="6">Screening student work(name the proportion of ECTS credits for eachactivity so that the total number of ECTS credits is equal to the ECTS value of the course)</td><td>Class attendance</td><td>1.0</td><td>Research</td><td></td><td>Practical training</td><td></td></tr>
<tr><td>Experimental work</td><td>1.0</td><td>Report</td><td></td><td>(Other)</td><td></td></tr>
<tr><td>Essay</td><td></td><td>Seminar essay</td><td></td><td>(Other)</td><td></td></tr>
<tr><td>Tests</td><td>0.5</td><td>Oral exam</td><td></td><td>(Other)</td><td></td></tr>
<tr><td>Written exam</td><td>5.0</td><td>Project</td><td></td><td>(Other)</td><td></td></tr>
<tr><td></td><td colspan="5"></td></tr>
<tr><td>Grading and evaluating student work in class and at the final exam</td><td colspan="6">A student can pass the entire exam by taking and passing two partial exams (tests) during the semester. Test passing score is 60%. Each test constitute 45% of the final exam score. Grades achieved through laboratory exercises will constitute 10% of the final score. Any of the partial exams passed during the semester is valid throughout the academic year.
Students who do not pass one of the partial exam or both of them have to take an written exam in the regular examination periods. Exam passing score is 60%.
Grades depending on the test score: 60% - 69% - satisfactory, 70% -79% - good, 80% -89% very good, 90% -100% - excellent.</td></tr>
<tr><td rowspan="2">Required literature (available in the library and 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">Wilson and Gisvold's Textbook of Organic Medicinal and Pharmaceutical Chemistry, J. H. Block, J. M.</td><td>1</td><td colspan="2"></td></tr>
</table>

	Beale, Jr. (Editors), Lippincott Williams & Wilkins, Philadelphia, 2004.		
	M. Mintas, S. Raić-Malić, Medicinska kemija, Medicinska naklada, Zagreb, 2009.	1	
	N. Raos, S. Raić-Malić, M. Mintas, Lijekovi u prostoru, farmakofori i receptori, Školska knjiga, Zagreb, 2005.	1	
	S. V. Bhat, B. A. Nagasampagi, M. Sivakumar, Chemistry of Natural Products, Springer-Narosa, Berlin, 2005.	1	
Optional literature (at the time of submission of study programme proposal)	R. Vardanyan, V. Hruby, Synthesis of Essential Drugs, Elsevier, Amsterdam, 2006.		
Quality assurance methods that ensure the acquisition of exit competences	Monitoring of quality assurance will be performed at three levels: (1) University Level, conducting surveys of students on teaching quality; (2) Faculty Level, by Quality Control Committee; (3) Lecturer's Level, monitoring and accepting suggestions of students and colleagues		
Other (as the proposer wishes to add)			

Microemulsions in applied chemistry

<table>
<tr><td colspan="2">NAME OF THE COURSE</td><td colspan="5">MICROEMULSIONS IN APPLIED CHEMISTRY</td></tr>
<tr><td>Code</td><td>KTH216</td><td>Year of study</td><td colspan="4">2.</td></tr>
<tr><td>Course teacher</td><td>PhD, Vesna Sokol, associate prof.</td><td>Credits (ECTS)</td><td colspan="4">3</td></tr>
<tr><td rowspan="2">Associate teachers</td><td rowspan="2">PhD, Perica Bošković, assistant</td><td rowspan="2">Type of instruction (number of hours)</td><td>L</td><td>S</td><td>E</td><td>F</td></tr>
<tr><td>15</td><td>15</td><td>30</td><td></td></tr>
<tr><td>Status of the course</td><td>elective</td><td>Percentage of application of e-learning</td><td colspan="4"></td></tr>
<tr><td colspan="7">COURSE DESCRIPTION</td></tr>
<tr><td>Course objectives</td><td colspan="6">Emphasize to students the importance and width of the field of application of micro-emulsions in various industries such as food, pharmaceutical, cosmetic, textile, as well as in biomedicine, biotechnology and synthesis of nanoparticles.
Acquisition of fundamental knowledge on the physico-chemical properties of conventional microemulsion and surfactant-free-microemulsion systems based on green chemistry.</td></tr>
<tr><td>Course enrolment requirements and entry competences required for the course</td><td colspan="6"></td></tr>
<tr><td>Learning outcomes expected at the level of the course (4 to 10 learning outcomes)</td><td colspan="6">Students will be able to successfully master the subject:
- to describe the structure of classical microemulsions and microemulsion systems without the presence of a surfactant so-called “Surfactant-Free-Microemulsions”; to define the differences in comparison to emulsion
-to explain the role of the surfactant and the importance of thermodynamic parameters in achieving a stable microemulsion system
- to determine the size and shape of the microemulsion aggregates and explain the dynamics of their growth
- to describe the basic principles and possibilities for application of different methods (spectroscopy, conductometrics, measuring viscosity, surface tension measurement, AFM, TEM, SANS) in the study of microemulsion systems
- to recognize the principles on which Green Chemistry reduces the negative effects of chemical processes and technologies on the environment
- to plan the laboratory procedures and independently to conduct an experiment in accordance with the plan of research
- to implement appropriate computer programs for numerical processing of experimental data and graphic representation of the results obtained; discuss the results and reach a conclusion at the end</td></tr>
<tr><td>Course content broken down in detail by weekly class schedule (syllabus)</td><td colspan="6">Lectures:
Week 1.: Introduction to microemulsion.
Week 2.: Characteristics and structure of microemulsion.
Week 3.: Differences between microemulsions and emulsions.
Week 4.: Conditions of of phase equilibrium and phase diagrams.
Week 5.: The surfactants and co-surfactants, and their characteristics.
6. and 7. week: Rheology of microemulsion and emulsion systems.
Week 8.: First partial exam.
9. and 10. week: Methods and experimental techniques of research microemulsion</td></tr>
</table>

<table>
<tr><td></td><td>system.
Week 11.: Surface tension and critical micelle concentration (c.m.c.).
Week 12: The microstructure of microemulsion aggregates.
Week 13.: The microemulsions without the presence of surfactant (“Surfactant-Free-Microemulsions”).
Week 14.: The application of microemulsion. Examples.
Week 15.: The second partial exam.

Laboratory exercises:
1.Ternary phase diagram - determination of characteristic areas of microemulsion system.
2. Conductometric determination of critical micelle concentration (c.m.c.) and thermodynamics of micellization reaction in the presence of surfactant.
3. Determination of solvation properties of microemulsion using UV-Vis spectroscopy - extraction efficiency of toxic analytes from contaminated soil and comparison with conventional solvents.
4. Conductometric determination of nanostructures in the microemulsion without the presence of surfactants.
5. Viscometric determining of percolating threshold of microemulsion system. Size and shape of microemulsion aggregates.

Seminar
Student will present the selected topic from the subject content in written form by seminar paper and oral presentation in PowerPoint.</td></tr>
<tr><td>Format of instruction</td><td>x lectures
x seminars and workshops
x exercises
□ on line in entirety
□ partial e-learning
□ field work
x independent assignments
x multimedia
x laboratory
□ work with mentor
□ (other)</td></tr>
<tr><td>Student responsibilities</td><td>Students are required to attend classes and actively participate in the teaching process. This will be recorded and evaluated in making a final assessment.</td></tr>
<tr><td>Screening student work(name the proportion of ECTS credits for eachactivity so that the total number of ECTS credits is equal to the ECTS value of the course)</td><td>
<table>
<tr><td>Class attendance</td><td>0.5</td><td>Research</td><td></td><td>Practical training</td><td>0.5</td></tr>
<tr><td>Experimental work</td><td>1</td><td>Report</td><td></td><td>(Other)</td><td></td></tr>
<tr><td>Essay</td><td></td><td>Seminar essay</td><td>1</td><td>(Other)</td><td></td></tr>
<tr><td>Tests</td><td></td><td>Oral exam</td><td></td><td>(Other)</td><td></td></tr>
<tr><td>Written exam</td><td></td><td>Project</td><td></td><td>(Other)</td><td></td></tr>
</table>
</td></tr>
<tr><td>Grading and evaluating student work in class and at the final exam</td><td>The course content is divided into two units that students take over partial exams or joining final exam at the end of the semester. The exam is considered passed if students achieve at least 60%. The final grade is based on the evaluation of partial exams. Grades: <60% not satisfied; 60-69% successful (2) 70-79% good (3), 80-89% very good (4), 90-100% excellent (5).</td></tr>
<tr><td>Required literature (available in the library and 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>R. Najjar, Microemulsions - An Introduction to</td><td></td><td>1</td></tr>
</table>
</td></tr>
</table>

	Properties and Applications, InTech, 2012.		
	C. Sell, The Chemistry of Fragrances-From Perfumer to Consumer, RSC Publishing, Ashford,UK, 2006.		1
	P. K. Bidyut, S.P. Moulik, Uses and applications of Microemulsions, Curr. Sci. 80 (2001) 990.		1
Optional literature (at the time of submission of study programme proposal)	P. Bošković, V. Sokol, T. Zemb, D. Touraud, W. Kunz. Weak Micelle-Like Aggregation in Ternary Liquid Mixtures as Revealed by Conductivity, Surface Tension, and Light Scattering, J. Phys. Chem. B 119 (2015) 9933. I. Kralova, J. Sjöblom Surfactants Used in Food Industry: A Review, J. Disper. Sci. Technol. 30 (2009) 1363. J. Drapeau, M. Verdier, D. Touraud, U. Kröckel, M. Geier, A. Rose, W. Kunz, Effective Insect Repellent Formulation in both Surfactantless and Classical Microemulsions with a Long-Lasting Protection for Human Beings, Chem. Biodivers. 6 (2009) 934. C. A. Katz, Z. J. Calzola, J. K. N. Mbindyo, Structure and Solvent Properties of Microemulsions, J. Chem. Educ. 85 (2008) 263. K. Holmberg, B. Jönsson, B. Kronberg, B. Lindman, Surfactants and polymers in aqueous solutions, John Wiley and Sons, Chichester, 2003. J.L. Salager, Surfactants: Types and Uses, Universidad de los Andes, 2002.		
Quality assurance methods that ensure the acquisition of exit competences	Quality of the teaching and learning, monitored at the level of the (1) teachers, accepting suggestions of students and colleagues, and (2) faculty, conducting surveys of students on teaching quality.		
Other (as the proposer wishes to add)			

Selected chapters from biochemistry

<table>
<tr><td colspan="2">NAME OF THE COURSE</td><td colspan="5">SELECTED CHAPTERS FROM BIOCHEMISTRY</td></tr>
<tr><td>Code</td><td>KTH217</td><td>Year of study</td><td colspan="4">2</td></tr>
<tr><td>Course teacher</td><td>PhD, Olivera Politeo, associate prof.</td><td>Credits (ECTS)</td><td colspan="4">4 ECTS</td></tr>
<tr><td rowspan="2">Associate teachers</td><td rowspan="2"></td><td rowspan="2">Type of instruction (number of hours)</td><td>L</td><td>S</td><td>E</td><td>F</td></tr>
<tr><td>30</td><td>15</td><td>-</td><td>-</td></tr>
<tr><td>Status of the course</td><td>elective</td><td>Percentage of application of e-learning</td><td colspan="4"></td></tr>
<tr><td colspan="7">COURSE DESCRIPTION</td></tr>
<tr><td>Course objectives</td><td colspan="6">The goal of this course is to teach students aboth specific and and important topics in the field of biochemistry .</td></tr>
<tr><td>Course enrolment requirements and entry competences required for the course</td><td colspan="6">Biochemistry I and Biochemistry II</td></tr>
<tr><td>Learning outcomes expected at the level of the course (4 to 10 learning outcomes)</td><td colspan="6">• Introduction to the structure and function of muscle tissue and cytoskeleton as well as functions of blood cells, plasma proteins and immunoglobulins.
• Understand the significance of acid-base balance in the body and buffers involved in its maintenance.
• Understand the significance of oxidative processes in the body and the antioxidant systems and methods.
• Learn about metabolism of fructose, galactose and mannose.
• Learn about hormons, signal transduction and lipid second messengers.
• Learn about other products of amino acids metabolism. Learn about porphyrin and heme metabolism and disorders connected with their metabolism.
• Understand the significance of nutrition, digestion and absorption of nutrients as well as micronutrients.
• Understand the significance of glycosylation and glycoproteins.
• Learn about xenobiotic metabolism and bioinformatics.</td></tr>
<tr><td>Course content broken down in detail by weekly class schedule (syllabus)</td><td colspan="6">LECTURES:
Muscle tissue and cytoskeleton. Blood cells. (2) Plasma proteins and Immunoglobulins.(2) Acid-base balance. (2) Biological Oxidation. Free Radicals. Antioxidants. (4) Metabolism of Other Hexoses.(2) Hormons and signal transduction.(2) Lipid Second Messengers (2) Other products of amino acids metabolism. (2) Porphyrin and Heme Metabolism (2) Micronutrients: Vitamins and Minerals. (2) Nutrition, digestion and absorption.(2) Glycoproteins. (2) Xenobiotic Metabolism. (2) Bioinformatics. (2)

SEMINARS:
Students will review and process the topics related to pathological conditions resulting from biochemical disorders.</td></tr>
<tr><td>Format of instruction</td><td colspan="3">□lectures
□exercises</td><td colspan="3"></td></tr>
<tr><td>Student responsibilities</td><td colspan="6">Class attendance, attending to experimental work and taking the final exam</td></tr>
</table>

Screening student work*(name the proportion of ECTS credits for eachactivity so that the total number of ECTS credits is equal to the ECTS value of the course)*	Class attendance	0,5	Research		Practical training	
	Experimental work		Report		(Other)	
	Essay		Seminar essay	**1**	(Other)	
	Tests	0,5	Oral exam		(Other)	
	Written exam	1	Project		(Other)	
Grading and evaluating student work in class and at the final exam	Class attendance, preparing seminar papers and taking the final exam.					

	Title	**Number of copies in the library**	**Availability via other media**
Required literature (available in the library and via other media)	R.M.Murray i sur: Harperova ilustrurana biokemija, 28th Ed, Medicinska naklada, Zagreb 2011.		
	J.M. Berg, J.L. Tymoczko, L. Stryer: Biokemija, 5th Ed, Školska knjiga Zagreb, 2013.		
	D. Čvorišćec i I. Čapelak (ur.): Štrausova medicinska biokemija. Medicinska naklada, 2009, Zagreb.		
	N. V. Bhagavan,Chung-Eun Ha: Essential of medicinal biochemistry: with clinical cases, Second Edition, Academic Press 2015, San Diegi, CA, USA.		

Optional literature (at the time of submission of study programme proposal)	D. Voet, J.G.Voet, C.W.Pratt: *Fundamental of Biochemistry*, Jonn Wiley & Sons Inc., NY, Chichester, Weinheim, Brisbane, Singapore, Toronto,1999 G. M. Cooper, R. E. Hausman. Stanica. 5.izdanje. 2010
Quality assurance methods that ensure the acquisition of exit competences	Monitoring of quality assurance will be performed at three levels: (1) University, (2) Faculty Level by Quality Control Committee, (3) Level of teachers.
Other (as the proposer wishes to add)	

Chemical sensors and biosensors

<table>
<tr><td colspan="2">NAME OF THE COURSE</td><td colspan="6">Chemical sensors and biosensors</td></tr>
<tr><td>Code</td><td>KTH218</td><td>Year of study</td><td colspan="5">2st year of graduate study</td></tr>
<tr><td>Course teacher</td><td>PhD, Marijo Buzuk, assistant prof.</td><td>Credits (ECTS)</td><td colspan="5">4</td></tr>
<tr><td rowspan="2">Associate teachers</td><td rowspan="2"></td><td rowspan="2">Type of instruction (number of hours)</td><td>P</td><td>S</td><td>V</td><td>T</td></tr>
<tr><td>30</td><td>0</td><td>15</td><td></td></tr>
<tr><td>Status of the course</td><td>Election</td><td>Percentage of application of e-learning</td><td colspan="5"></td></tr>
<tr><td colspan="7">OPIS PREDMETA</td></tr>
<tr><td>Course objectives</td><td colspan="6">Students will get insight into actual achievements in chemical and biochemical sensing systems. Basic principles and kind of chemical and biochemical sensor systems will be presented together with problems that can arise during development process of such sensors systems (sensors material or biomaterial, recognition mechanism, choosing appropriate transducer element, configuration and practical development of sensors. Furthermore, practical applicability of chemical sensors and biosensors in medical, industrial and environmental analysis will be given.</td></tr>
<tr><td>Course enrolment requirements and entry competences required for the course</td><td colspan="6">-</td></tr>
<tr><td>Learning outcomes expected at the level of the course (4 to 10 learning outcomes)</td><td colspan="6">1. To recognize and characterize sensors systems.
2. To propose and to development novel sensors systems, together with improvement of current ones.
3. To use a knowledge in selection of appropriate sensors systems for various analytes in different area of application.
4. To get specific insight into recognition principles, amplification and transduction of chemical signal into various outcome signals.</td></tr>
<tr><td>Course content broken down in detail by weekly class schedule (syllabus)</td><td colspan="6">1. General aspects and introduction in chemical sensors and biosensors-definition, terminology.
Classification of sensors (electrochemical, optical, piezoelectrical, termal, aqoustic). Phenomenon (recognition mechanism) that can be applied in sensors systems. Novel trends and scopes in sensors development (nanotechnology, nanostructure, "smart" sensors, in vivio sensors)
2. Basic construction concepts of sensors and biosensors. Example of commercial sensors and biosensors (ion-selective electrodes, glucometer, Elisa assay). Chemical and biochemical recognition mechanism. Recognition elements: ionophores, enzymes, crystals. Criterion for recognition elements selection. Biochemical selectivity and stability of recognition elements-problems.
3. Matrix material of sensors. Role and characteristics of matrixes. Recognition element immobilization methods. Incorporation of recognition elements into various matrixes (gels, polymers: conducting or non-conducting, carbon materials: paste, screen-printing, carbon nanotubes). Covalent binding of enzymes, cross-linking, physical adsorption.
4. Transducer for electrochemical, optical, piezoelectrical sensors. Selection of transducing element. Electrochemical sensors: potentiometric,</td></tr>
</table>

	amperometric. Modiffied electrodes. Preparation of ion-selective electrodes-techniques. Conducting surface, modified layer, signal transducing. Microelectrodes, FET sensors. 5. Optical sensors. Absorption, UV absorption, reflectometry, luminescence. Optical fibers sensors. Intrinsic and extrinsic sensors. Application of optical sensors in sensing of pH, pressure, temperature, humidity. Determination of biomolecules with optical sensors-luciferase in ATP detection and bacterial redox systems with luciferase in NADPH detection. 6. Piezoelectrical sensors. General aspects. Acoustic sensors. Incorporation of recognition elements. 7. Biosensors. Electrochemical, optical, immunosensors, optical sensors. First, second and third generation of biosensors. 8. Examples of the three generation of biosensonsors-amperometric determination of glucose. Redox interference. Oxygen dependence of the signal. Peroxide role. *in vitro* and *in vivo* continuously monitoring of glucose. Modern scopes in development of glucometers. Commercialization of sensors. 9. Immunosensors. Antibody-antigen bonding as mechanism of recognition. Electrochemical, optical, immunosensors, optical immunosensors. Examples of immunosensors for hemoglobin, erythrocytes, t-lymphocytes, viruses and bacterial. ELISA test. 10. DNA detection. DNA electrochemical sensors. Electrochemistry of DNA and detection principles. Immobilization of DNA sequences onto different materials. Electrodes processes-hybridization. Enzyme labeled DNA sequences. 11. Bionseors for pesticide detection. Enzymes used for pesticide detection. Basic concepts. Inhibition mechanism. Catalytically based biosensors. Immunosensors for pesticides determination. Enzymes reactivation. Microorganism, issue, cells as recognition elements. 12. Nanomaterial in optical and electrochemical biosensors. Carbon nanotubes (CNT) in biosensors preparation. CNT composite materials. 13. Introduction in direct transfer of electrons by proteins. Protein immobilization techniques. Examples: cytochrome c, myoglobine, hemoglobine. Role of CNT. Direct electron transfer from enzyme onto electrode. Examples: glucose oxidase, catalase, HRP. 14. Evaluation of sensors: selectivity, sensitivity, reproducibility, repeatability. Other types of sensors: impedance sensors, sensors for gases. 15. Highly sophisticated sensors systems: microelectro-machanical systems (MEMS and Bio(MEMS)), Lab-on-a-chip, nanosensors, biochips. Lab courses: 1. Preparation of potentiometric sensors by incorporation of ionophores in polymer matrix. Components ratio influences onto sensor characteristics. Determination of heavy metals in water. Selectivity of prepared sensor. 2. Amperometric determination of amino acids onto crystal and bismuth modified electrodes. Electrode preparation, characterization, influences of parameters on signal quality. 3. Preparation of the biosensors for determination of glucose. Incorporation of glucoso oxidase into carbon paste. MnO_2 as transducing element. Interferences. Role of Nafion® in improvment of the signal. Determination of glucose in real samples	
Format of	x lectures	☐ independent assignments

<table>
<tr><td>instruction</td><td colspan="6">☐ seminars and workshops
x exercises
☐ on line in entirety
☐ partial e-learning
☐ field work</td><td colspan="2">☐ multimedia
x laboratory
☐ work with mentor
☐ (other)</td></tr>
<tr><td>Student responsibilities</td><td colspan="8">The 80% presence at lectures and completed all laboratory exercises.</td></tr>
<tr><td rowspan="5">Screening student work (name the proportion of ECTS credits for each activity so that the total number of ECTS credits is equal to the ECTS value of the course)</td><td>Class attendance</td><td>1</td><td>Research</td><td></td><td>Practical training</td><td></td></tr>
<tr><td>Experimental work</td><td>1</td><td>Report</td><td></td><td>(Other)</td><td></td></tr>
<tr><td>Essay</td><td></td><td>Seminar essay</td><td>0.5</td><td>(Other)</td><td></td></tr>
<tr><td>Tests</td><td></td><td>Oral exam</td><td></td><td>(Other)</td><td></td></tr>
<tr><td>Written exam</td><td>0.5</td><td>Project</td><td></td><td>(Other)</td><td></td></tr>
<tr><td>Grading and evaluating student work in class and at the final exam</td><td colspan="8">Prior to joining the laboratory exercises, students' knowledge of the material concerned exercises will be verified by tests. All exercises must be completed.
The exam consists of a written examination. The written part of the exam lasts two hours. The written part of the exam is evaluated as follows:
Exactly solved more than 55 % - sufficient
Exactly solved more than 70 % - good
Exactly solved more than 80 % - very good
Exactly solved more than 90 % - excellent

A complete examination or part thereof may be installed through two partial tests during the semester. The tests cover material presented in lectures and lab courses. Written tests are evaluated in the following manner:
Exactly solved more than 55 % - released a written exam
Exactly solved by 60 % - freed written and oral - sufficient
Exactly solved by 70 % - freed written and oral - good
Exactly solved by 80 % - freed written and oral - very good
Exactly solved by 90 % - freed written and oral - excellent
It is necessary to pass all tests in order to pass the exam. Students who did not meet any of the tests must take written and oral exam of that part.
Also, essays make a basis for discussions and are rooted in the central parts of the syllabus for the course in question. Essays can be written on the basis of the course literature and lectures and will be presented to all course participants.</td></tr>
<tr><td rowspan="3">Required literature (available in the library and via other media)</td><td colspan="6">Title</td><td>Number of copies in the library</td><td>Availability via other media</td></tr>
<tr><td colspan="6">Florinel-Gabriel Bănică, Chemical Sensors and Biosensors: Fundamentals and Applications, John Wiley & Sons, Ltd, 2012.</td><td></td><td></td></tr>
<tr><td colspan="6">E. Palecek, F. Scheller, J. Wang Electrochemistry of Nucleic Acids and Proteins, Elsevier, 2005.</td><td></td><td></td></tr>
</table>

	Xueji Zhang, Huangxian Ju, Joseph Wang, Electrochemical Sensors, Biosensors and Their Biomedical Applications, Elsevier, 2008.		
	E. Turkušić, Uvod u hemijske senzore i biosenzore, PMF Sarajevo, 2012		
Optional literature (at the time of submission of study programme proposal)	-		
Quality assurance methods that ensure the acquisition of exit competences	- Information from interviews, observations, and consultation with students during lectures - Student survey		
Other (as the proposer wishes to add)			

Environmental managment system

NAME OF THE COURSE	ENVIRONMENTAL MENAGMENT SYSTEM					
Code	KTH205	Year of study	2st year of graduate study			
Course teacher	PhD, Marijo Buzuk, assistent prof.	Credits (ECTS)	6.0			
Associate teachers	PhD, Maša Buljac, assistant prof.	Type of instruction (number of hours)	L	S	E	F
			30	15	30	
Status of the course	Optional	Percentage of application of e-learning				

COURSE DESCRIPTION	
Course objectives	The main objective of this course is an introducing students to the steps and processes during the implementation of the ISO 14001 standard in business subjects and in possible problems that arising from the implementation process and to resolve issue. Furthermore, one of the goals of this course is to introduce students to the development and future trends in the development of international norms that it is needed for understanding and applying them in various systems.
Course enrolment requirements and entry competences required for the course	None
Learning outcomes expected at the level of the course (4 to 10 learning outcomes)	1. Students will understand the concept of integrated environmental protection, sustainable development, and will have ability to measure and proceed for the protection of the environment. 2. Based on the previous point, students will be able to participate in area planning, according to principles of sustainable development and to be able to estimate the impact on the environment (either Strategic Impact Assessment or any estimation of the environmental impact). 3. Students will have the ability to estimate risk and to manage it, as well as its the quantitative and qualitative representation. 4. Students will be able to participate in the process of planning and management of environment, relating to the study of the environmental impact, and therefore in the Commission for Strategic Studies and Environmental Strategy. 5. By discussing about the Regulations on Environmental Impact Estimation and the steps in the preparation of studies, students will gain knowledge that is inevitable in implementation of various Estimation and Environmental Programme. 6. Students will acquire the competencies that will provide them as experts in selecting the best available technique for a specific activity according to the European guidelines . They will be able to identify and resolve nonconformities that occur during this process . 7. Students will be able to apply the knowledge in organizations that have implemented an Environmental Management System ISO 14001 , and in the segment with its maintenance and improvement. 8. Students will acquire knowledge that will enable them to be an important subjects and managers to establish the system of ISO 14001 in various subjects. 9. Students will be able to apply the knowledge for implementation,

	maintenance and development of EMS.
Course content broken down in detail by weekly class schedule (syllabus)	**Lecture 1:** The definition of technology ; similarities and differences ; historical development of the term . Impacts and Challenges of technology . The separations technology. **Lecture 2:** Definition ecosystem, classification. Environment Protecting the environment. Pollution and contamination. Legal provisions in the RH. **Lecture 3:** Sustainable Development; concepts, vision, future. Sustainable development laws of thermodynamics. The path towards sustainable development. **Lecture 4:** Types of Environmental Protection. Integrated approach. The measures and procedures to protect the environment. The political and sociological approach, legal measures. **Lecture 5:** Planning and management of the area. Basic documents of Environmental Protection. The environmental impact assessment. Risk management. Cost-benefit analysis. **Seminar and Exercise 1 (2 × 4 hours):** Consideration and discussion of objectives and approach strategies, programs, studies on the process of planning and environment management. **Lecture 6:** A study of the environmental impact - steps in the preparation . Legal provisions. **Seminar and Practice 2 (2 × 4 hours):** Consideration and discussion of goals and approach to the study of the environmental impact. The debate about the roles of various professionals, overlapping powers and competencies, and suggestions dismissal of the non-compliance! The interest of the community vs. capital interest. **Lecture 7:** Methodology of the best available techniques. **Seminar and Exercise 3 (2 × 4 hours):** A critical review of the methodology for the assessment of best available techniques - debates , discussions, debates , proposals . Development of algorithms and schemes for assessing best available techniques. **Seminar and Exercise 4 (2 × 4 hours):** Evaluating and choosing the best available techniques for different procedures with the help of the guidelines . Landfills, waste gases , waste incinerators , cement industry , etc .... **Lecture 8:** Systems - definition. Standards and Standardization. Croatian Standards Institute. Accreditation and certification. Types of norms. **Lecture 9:** ISO. ISO 14001 Environmental Policy. Plan. **Seminar and Exercise 5 (2 × 4 hours):** Development of ISO 14001 on examples of different organizations. Environmental policy. Plan.

	Lecture 10: ISO 14001 Implementation and operational phases. Testing and verification. **Seminar and Exercise 6 (2 × 5 hours):** Development of ISO 14001 on examples of different organizations. Implementation and operational phases. Testing and verification. **Lecture 11:** The definition of quality. Family 9001 standard procedure of introducing a system of quality. **Lecture 12:** General requirements of quality management systems and requirements relating to documentation. **Lecture 13:** ISO 9001 Document Control and inspection records. Management responsibility and quality policy. **Lecture 14:** Planning Quality Management System. Resource management. Control and improve the system. Self-evaluation. **Lecture 15:** Integration of standards 14001 and 9001 in a joint management system. Similarities and differences . **Seminar and Exercise 7 (2 × 5 hours):** Integration of standards 14001 and 9001 in a joint management system for the various economic operators.

Format of instruction	×lectures ×seminars and workshops □exercises □*on line*in entirety □partial e-learning □field work	×independent assignments □multimedia □laboratory □work with mentor □ (other)
Student responsibilities		

Screening student work*(name the proportion of ECTS credits for eachactivity so that the total number of ECTS credits is equal to the ECTS value of the course)*						
	Class attendance	2	Research		Practical training	
	Experimental work		Report		(Other)	
	Essay		Seminar essay	1	(Other)	
	Tests		Oral exam	1	(Other)	
	Written exam	2	Project		(Other)	

Grading and evaluating student work in class and at the final exam	During semester two exams will be performed. Final examinations will be administered during formal examination periods. The following percentage equivalents apply to final grade: <55% Failure; 56%-66% (2); 67%-78% (3); 79%-90% (4);> 90% (5). After written exam, student will attend to oral exam. Lecturers do not give grades. Students earn grades.

Required literature (available in the library and via other media)	**Title**	**Number of copies in the library**	**Availability via other media**
	M. Buzuk, Sustavi upravljanja okolišem (u pripremi),	0	personal

	Kemijsko-tehnološki fakultet, Split, 201X	X	
	Tonći Lazibat, Poznavanje robe i upravljanje kvalitetom, Sinergija, Zagreb, 2005.		by mail
	Smjernice za najbolje raspoložive tehnike MZOIP		www
Optional literature (at the time of submission of study programme proposal)			
Quality assurance methods that ensure the acquisition of exit competences			
Other (as the proposer wishes to add)			

Naturally occuring polymeric materials

NAME OF THE COURSE	NATURALLY OCCURING POLYMERIC MATERIALS					
Code	KTH213	Year of study	2nd			
Course teacher	PhD, Branka Andričić, prof.	Credits (ECTS)	6.0			
Associate teachers		Type of instruction (number of hours)	L	S	E	F
			30		30	
Status of the course	Optional	Percentage of application of e-learning				

COURSE DESCRIPTION	
Course objectives	Gaining of the basic theoretical and practical knowledge on origin and properties of naturally occurring polymers and their application.
Course enrolment requirements and entry competences required for the course	
Learning outcomes expected at the level of the course (4 to 10 learning outcomes)	- distinguish naturally occurring polymers and their resources - be ble to explain the structure and properties of naturally occurring polymers - be acquainted with application fields of naturally occurring polymers - distinguish naturally occurring polymers according burning characteristics
Course content broken down in detail by weekly class schedule (syllabus)	1st week: An overview of basic terms in polymers and polymeric materials. Basic characteristic of macromolecules. 2nd week: Definition of naturally occurring polymers in narrow and broad sense. PLA and PHB: synthesis and properties. Molecular and supermolecular structure of polymers. 3rd week: Starch: structure and properties. Modification and application of starch. 4th week: Structure and properties of cellulose. Microcrystalline cellulose. Natural cellulose fibres. Mercerization and crosslinking of cotton fibres. 5th week: Regenerated cellulose. Cellulose derivates. Alginic acid and alginates. Structure and application of alginates. Ion exchange. 6th week: Other polysaccharides. Structure, properties and application of lignin. 7th week: Ponavljanje. First test. 8th week: Amino acides in proteins. Primary, secondary and tertiary structure of proteins. 9th week: Protein fibres. Structure and properties of silk fibre. Structure and properties of wool. 10th week: Structure and properties of collagen. Collagen based materials. 11th week: Casein: structure, phase separation, application. An overview of natural fibres properties. 12th week: Natural caoutchouc. Derivates of natural caoutchouc. Mastication and vulcanization. 13th week: Shaping of caoutchouc and production of rubbery products (tires etc.) Reuse and recycling of rubber. Regeneration of caoutchouc. 14th week: Plastic and rubbery waste management system. Natural resins. 15th week: Ponavljanje. Second test. Laboratory exercises:

<table>
<tr><td></td><td colspan="6">1. Preparation of thermoplastic starch
2. Regeneration of cellulose. Identification of natural fibres by burning tests.
3. Immobilization of bakers yeast on alginate
4. Gelatine swelling
5. Isolation of casein and preparation of casein glue</td></tr>
<tr><td>Format of instruction</td><td colspan="3">X lectures
□ seminars and workshops
□ exercises
□ on line in entirety
□ partial e-learning
□ field work</td><td colspan="3">□ independent assignments
X multimedia
X laboratory
□ work with mentor
□ (other)</td></tr>
<tr><td>Student responsibilities</td><td colspan="6"></td></tr>
<tr><td rowspan="6">Screening student work(name the proportion of ECTS credits for each activity so that the total number of ECTS credits is equal to the ECTS value of the course)</td><td>Class attendance</td><td>1.0</td><td>Research</td><td></td><td>Practical training (report on exp. work)</td><td>0.2</td></tr>
<tr><td>Experimental work</td><td>1.0</td><td>Report</td><td></td><td>Tests before experimental work</td><td>0.2</td></tr>
<tr><td>Essay</td><td></td><td>Seminar essay</td><td>1.0</td><td>(Other)</td><td></td></tr>
<tr><td>Tests</td><td>0.6</td><td>Oral exam</td><td>0.4</td><td>(Other)</td><td></td></tr>
<tr><td>Written exam</td><td>0.6</td><td>Project</td><td></td><td>(Other)</td><td></td></tr>
<tr><td colspan="6"></td></tr>
<tr><td>Grading and evaluating student work in class and at the final exam</td><td colspan="6">The complete exam can be passed through two tests during semester. The passing score is 60 % and the fraction of each test is 35%. In final grade laboratory exercises has fraction of 25% and the seminar essay has fraction of 5%. In the exam period the student has to attend to written and oral exam (passing score is 60%). Written exam is 35% and oral exam is 35%.
Grades: successful (60% – 70%), good (71% – 80%), very good (81% – 90%), excellent (91% – 100%).</td></tr>
<tr><td rowspan="2">Required literature (available in the library and 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">B. Andričić, Prirodni polimerni materijali, Priručnik, Sveučilište u Splitu, Split, 2008.</td><td>1</td><td>KTF web library</td></tr>
<tr><td>Optional literature (at the time of submission of study programme proposal)</td><td colspan="6">C. E. Carracher, Seymour/Carraher's Polymer Chemistry, 4th Ed., Marcel Dekker, New York, 1996.</td></tr>
<tr><td>Quality assurance methods that ensure the acquisition of exit competences</td><td colspan="6">Quality of the teaching and learning, monitored at the level of the (1) teachers, accepting suggestions of students and colleagues, and (2) faculty, conducting surveys of students on teaching quality.</td></tr>
<tr><td>Other (as the proposer wishes to add)</td><td colspan="6"></td></tr>
</table>

Colloid chemistry

NAME OF THE COURSE	Colloid Chemistry					
Code	KTH214	Year of study	2.			
Course teacher	PhD, Vesna Sokol, assistant prof.	Credits (ECTS)	6.0			
Associate teachers		Type of instruction (number of hours)	L	S	E	F
			30	15	30	
Status of the course	Elective	Percentage of application of e-learning				
COURSE DESCRIPTION						
Course objectives	Students will expand basic knowledge of colloid chemistry obtained from lectures in Physical Chemistry. They will learn principles and applications of surface and colloid chemistry.					
Course enrolment requirements and entry competences required for the course						
Learning outcomes expected at the level of the course (4 to 10 learning outcomes)	Students will upon completion of the course 1) know the modern instrument methods of separation, purification and identification of colloids, 2) be able to interpret properties and effects of surfactants (micellar colloids), 3) be able to explain the kinetic phenomena of colloidal solutions, 4) understand the electrokinetic phenomena, 5) be able to explain the rheological properties of colloidal system.					
Course content broken down in detail by weekly class schedule (syllabus)	<u>Lectures</u> 1st week: Introduction. Classification of colloidal systems. Aggregation of colloidal particles. 2nd week: Micelle formation. Properties and structure of micelles in aqueous and non-aqueous solutions. 3rd week: Purification and separation of colloids, ultrafiltration, reverse osmosis. 4th week: Dialysis, lyophilization, gel filtration. 5th week: Size and shape of colloidal particles. Experimental techniques for determining the size and shape of the colloidal particles. 6th week: Kinetic properties of the colloidal systems, sedimentation, diffusion, osmotic pressure. 7th week: Interface Phenomena: liquid-gas, liquid-liquid, solid-liquid interface. 8th week: Viscosity of colloidal systems. 9th week: Experimental techniques for determining the surface composition. 10th week: Rheology of colloidal systems. 11th week: Electrical double layer, electrophoresis. 12th week: Electrokinetic potential and electrical mobility, electrokinetic phenomena. 13th week: Coagulation and stability of colloids. 14th week: Gel, membrane, biological membrane. 15th week: Emulsions and microemulsions. <u>Laboratory exercises</u> 1. Microemulsions, size of microemulsions aggregates and dynamic. 2. Surface tension. 3. Critical micelle concentration. 4. Standard Gibbs energies of micellization of surfactants in aqueous solutions at different electrolyte concentrations. 5.					

	Microstucture and stability in surfactant free microemulsions.					
Format of instruction	xlectures xseminars and workshops xexercises □*on line*in entirety □partial e-learning □field work			xindependent assignments xmultimedia xlaboratory □work with mentor □ (other)		
Studentresponsibilities	Students are required to attend classes and actively participate in the teaching process. This will be recorded and evaluated in making a final assessment.					
Screening student work*(name the proportion of ECTS credits for eachactivity so that the total number of ECTS credits is equal to the ECTS value of the course)*	Class attendance	1.5	Research		Practical training	
	Experimental work	1	Report		(Other)	
	Essay		Seminar essay	0.5	(Other)	
	Tests	1	Oral exam	1	(Other)	
	Written exam	1	Project		(Other)	
Grading and evaluating student work in class and at the final exam	The course content is divided into two units that students take over partial exams or joining final exam at the end of the semester. The exam is considered passed if students achieve at least 60%. The final grade is based on the evaluation of partial exams. Grades: <60% not satisfied; 60-69% successful (2) 70-79% good (3), 80-89% very good (4), 90-100% excellent (5).					

Required literature (available in the library and via other media)	**Title**	**Number of copies in the library**	**Availability via other media**
	K. S. Birdi, Surface and Colloid Chemistry, Principles and Applications, CRC Press, Boca Raton, London; New York, 2010.	1	
	P. C. Hiemenz, R. Rajagopalan, Principles of Colloid and Surface Chemistry, 3rd Edition, Marcel Dekker, New York, 1997.	1	

Optional literature (at the time of submission of study programme proposal)	Duncan J. Shaw, Introduction to Colloid and Surface Chemistry, 4th Edition, Butterrorth-Heinemann, Oxford, 1992.
Quality assurance methods that ensure the acquisition of exit competences	Quality of the teaching and learning, monitored at the level of the (1) teachers, accepting suggestions of students and colleagues, and (2) faculty, conducting surveys of students on teaching quality.
Other (as the proposer wishes to add)	

Quality assurance and accreditation in laboratory practice

NAME OF THE COURSE	Quality Assurance and Accreditation in Laboratory Practice					
Code	KTH215	Year of study	2nd			
Course teacher	PhD, Josipa Giljanović, associat prof.	Credits (ECTS)	6,0			
Associate teachers		Type of instruction (number of hours)	L	S	E	F
			30	15	28	2
Status of the course	Elective	Percentage of application of e-learning	30%			
COURSE DESCRIPTION						
Course objectives	Acquisition of basic knowledge about basic concepts and principles of quality management, requirements and criteria of testing laboratories according to the requirements of EN ISO / IEC 17025 standard.					
Course enrolment requirements and entry competences required for the course	Completed appropriate undergraduate study					
Learning outcomes expected at the level of the course (4 to 10 learning outcomes)	1. Understanding the quality menagement system in the laboratory including accreditation process laws and standards for accreditation 2. Apply laboratory tests, methods, the process of mesurements, uncertainty, quality control and documentation of the laboratory 3. Understand evaluation off laboratories tests, accreditation of laboratories, the system of authorization and accreditation in Europe and Croatia. 4. Apply knowledge in practice and link the theoretical knolidge with real problems in the laboratorywork.					
Course content broken down in detail by weekly class schedule (syllabus)	1st week: Analytical system. Sampling from the environment. Seminar: Solving problems. 2nd week: Preparation of the sample for analysis. Seminar: Solving problems. 3rd week: Method of isolation of the analyte from the nuts: solid phase extraction, microwave ultrasonic extraction. Seminar: Solving problems. 4th week: Spectroscopic methods. Molecular Spectroscopy. Seminar: Solving problems. 5th week: Atomic absorption spectroscopy, mass spectroscopy. Seminar: Solving problems. 6th week: Chromatographic methods: gas, ion, thin layer chromatography. Seminar: Solving problems. 7th Week : 1st. partial exam, solving the test 8th week: The standard methods and reference materials, validation. Seminar: Solving problems 9th week: sample for analysis, records, process evaluation and report, Seminar: Solving problems 10th week: subcontracting, external services and procurement; appeal. Seminar: Solving problems 11th week: GLP-principles, and procedures. Seminar: Solving problems 12th week: A system of authorization and accreditation in Europe and Croatia, principles and rules. Seminar: Solving problems					

<table>
<tr><td></td><td colspan="6">13th week:. The requirements of EN ISO / IEC 17025 (current edition). Seminar: Solving problems
14th week: The requirements of EN ISO / IEC 17025 (current edition). Seminar: Solving problems
15th week : 2nd partial exam , solving the test
<u>List of Exercises</u>

documentation of good laboratory practice
individual documentation for ISO / IEC 17025: 2005
Development of manual quality
internal audits
visit to the Veterinary Institute Split</td></tr>
<tr><td>Format of instruction</td><td colspan="3">☒ lectures
☒ seminars and workshops
☒ exercises
□on linein entirety
□partial e-learning
□field work</td><td colspan="3">□independent assignments
☒ multimedia
☒ laboratory
□work with mentor
□ (other)</td></tr>
<tr><td>Studentresponsibilities</td><td colspan="6">Lectures attendance - at least 80% and completing exercises</td></tr>
<tr><td rowspan="6">Screening student work(name the proportion of ECTS credits for eachactivity so that the total number of ECTS credits is equal to the ECTS value of the course)</td><td>Class attendance</td><td>0.5</td><td>Research</td><td></td><td>Practical training</td><td></td></tr>
<tr><td>Experimental work</td><td></td><td>Report</td><td></td><td>Laboratory Exercises</td><td>1.0</td></tr>
<tr><td>Essay</td><td></td><td>Seminar essay</td><td>1.5</td><td>(Other)</td><td></td></tr>
<tr><td>Tests</td><td></td><td>Oral exam</td><td>1.0</td><td>(Other)</td><td></td></tr>
<tr><td>Written exam</td><td>1.0</td><td>Project</td><td>1.0</td><td>(Other)</td><td></td></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Grading and evaluating student work in class and at the final exam</td><td colspan="6">The entire test can be applied over two partial tests during the semester. Passing threshold is 60%. Each test in assessing participates with 50%. Lectures presence of 80 to 100% is 10% marks. The examination periods there is a written and oral exam. Passing threshold is 60%. Passing one partial test of any part (previous activity) is valid throughout current academic year. Written exam has a share of 50% and oral examination also 50%. Students who have not passed the partial tests will have oral examination in the regular examination period. Passing threshold is 60% and the examination form to participate in the evaluation by 50%.

Rating: 60% -69% - satisfactory, 70% -79% - good, 80% -89% very good, 90% - 100% - excellent.</td></tr>
<tr><td rowspan="2">Required literature (available in the library and 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">1. HRN EN ISO/IEC 17025:2005-Opći zahtjevi za osposobljenost ispitnih i umjernih laboratorija; , zakoni, propisi;
2. Guide to Quality in Analytical Chemistry, CITAC/EURACHEMGUIDE Edition (2002), 3. M.Kaštelan-Macan, Kemijska analiza u sustavu kvalitete, Školska knjiga, Zagreb (2003),</td><td>3</td><td colspan="2">Web page of the Department

http://www.eurachem.ul.pt/guides/valid.pdf),htt</td></tr>
</table>

			p://www.akreditacija.hr/; http://www.svijet-kvalitete.com/index.php/umjeravanje/504-postupak-akreditacije-laboratorija; http://www.european-accreditation.org/; Guide to Quality in Analytical Chemistry An Aid to Accreditation (http://pdf-world.net/pdf/31643/Guide-to-Quality-in-Analytical-Chemistry-pdf.php)
Optional literature (at the time of submission of study programme proposal)			
Quality assurance methods that ensure the acquisition of exit competences	• registration of student's presence in class • annual analysis of students success in this course • student's survey in order to evaluate the professor • professor's self-evaluation		
Other (as the proposer wishes to add)			

Chemistry of materials

NAME OF THE COURSE	Chemistry of Materials					
Code	KTI302	Year of study	2st year of graduate study			
Course teacher	PhD, Marija Bralić, associate prof.	Credits (ECTS)	6.0			
Associate teachers	PhD, Maša Buljac, assistant prof. MSc, Goran Olujić, assistent	Type of instruction (number of hours)	L	S	E	F
			30	15	30	
Status of the course	Optional	Percentage of application of e-learning				
COURSE DESCRIPTION						
Course objectives	The basic objective of the course is to acquire knowledge about the chemical and physical properties of materials.					
Course enrolment requirements and entry competences required for the course						
Learning outcomes expected at the level of the course (4 to 10 learning outcomes)	After course students will be able to : 1. chemical characteristics of the material. 2. physical characteristics of the material: electrical, thermal, optical, magnetic and mechanical properties 3. materials: conductors, semiconductors, metals, ceramics, polymers, composites 4. sampling of different materials 5. preparation of a representative sample for analysis					
Course content broken down in detail by weekly class schedule (syllabus)	**Lecture 1:** Introduction. The chemical characteristics of the material **Lecture 2:** Chemical bond, the crystal lattice. **Lecture 3:** Physical characteristics of the material: electrical, thermal, optical, magnetic and mechanical properties **Seminar 1 (2 hours):** Data analysis and presentation of results. Assignments: Tests of acceptance and rejection results **Lecture 4:** Physical characteristics of the material: electrical, thermal, optical, magnetic and mechanical properties **Seminar 2 (2 hours):** The standard deviation of error. Calculate the mass of the sample **Lab course 1 (2 hours):** Familiarization with laboratories, institutes and exercises that will take place. **Lecture 5:** Groups of materials: conductors, semiconductors, metals, ceramics, polymers **Seminar 3 (2 hours):** Calculation of the composition of various solid materials. Shares, tasks with different problems **Lab course 2 (5 hours):** Standardization PO_4. Determination of PO_4 from seawater in HDPE and PP bottles and glass tubes **Lecture 6:** Testing and analysis of real samples **Lecture 7:** first partial colloquium **Lab course 3 (5 hours):** Standardization of NO_2. Determination of NO_2 from seawater in HDPE and PP bottles and glass tubes **Lecture 8:** Sampling of gases					

<table>
<tr><td></td><td colspan="6">Seminar 4 (2 hours): Assignments from the method of discharge. Assignments: interference-extraction
Lab course 4 (6 hours): Standardization SiO_4. Determination SiO_4 from seawater in HDPE and PP bottles and glass tubes
Lecture 9:. Sampling of liquid
Seminar 5 (2 hours): Separation and error calculation. Calculations of components of the various components in an aqueous system,
Lecture 10: Sampling of solid
Seminar 6 (2 hours): Eligible and illicit quantity calculations for solids
Lab course 5 (5 hours): Standardization of NO_3. Determination of NO_3 from seawater in HDPE and PP bottles and glass tubes
Lecture 11: Preparation of a representative sample for analysis
Seminar 7 (2 hours): Assignments: gases, calculations composition
Lecture 12: Preparation of a representative sample for analysis
Lecture 13: Decomposition of samples
Lecture 14: Seminar
Lab course 6 (4 hours): Sandardizacija NH_4. Determination of NH_4 from seawater in HDPE and PP bottles and glass tubes
Lecture 15: 2th partial colloquium
Seminar 8 (1 hour): Assignments: gases, calculations composition
Lab course 7 (3 hours): Computer and graphical analysis of the results</td></tr>
<tr><td>Format of instruction</td><td colspan="3">×lectures
×seminars and workshops
×exercises
□on linein entirety
□partial e-learning
□field work</td><td colspan="3">□independent assignments
□multimedia
×laboratory
□work with mentor
□ (other)</td></tr>
<tr><td>Studentresponsibilities</td><td colspan="6"></td></tr>
<tr><td rowspan="6">Screening student work(name the proportion of ECTS credits for eachactivity so that the total number of ECTS credits is equal to the ECTS value of the course)</td><td>Class attendance</td><td>0.5</td><td>Research</td><td></td><td>Practical training</td><td></td></tr>
<tr><td>Experimental work</td><td>1</td><td>Report</td><td></td><td>(Other)</td><td></td></tr>
<tr><td>Essay</td><td></td><td>Seminar essay</td><td>0.5</td><td>(Other)</td><td></td></tr>
<tr><td>Tests</td><td>1</td><td>Oral exam</td><td>2</td><td>(Other)</td><td></td></tr>
<tr><td>Written exam</td><td>1</td><td>Project</td><td></td><td>(Other)</td><td></td></tr>
<tr><td></td><td colspan="5"></td></tr>
<tr><td>Grading and evaluating student work in class and at the final exam</td><td colspan="6">During the semester, the two partial test to check if the knowledge of students from courses included material. During the semester students will be selected from the lecture topic to make a seminar that will affect the final grade. After completion of the semester, students take a written exam courses included material from the seminar. If the student meets at one of the partial tests during the semester, material from passing the test does not need to take the written exam. After passing the written part of the exam, the oral exam. Prior to joining the laboratory exercises, students' knowledge of material from the respective exercise will be verified by tests. All exercises must be passed all preliminary exams and completed. The student has the right to exercise fail one exercise, but you will catch up at the end of the semester. For all aspects of teaching evaluation will be conducted according to the following criteria: <55% inadequate; 55% -65% is sufficient; 66% -75% good; 76% -85% very good;> 86% excellent. The final grade will be the arithmetic average of ratings from exercises, written assessment and oral examination.</td></tr>
</table>

	Title	Number of copies in the library	Availability via other media
Required literature (available in the library and via other media)	Yitzhak Mastai**,** Materials Science: Advanced Topics, InTech 2013 W.D.Callister Jr.and D.G. Rethwisch, Fundamentals of materials science and engineering; An integrated approach, RP Library, 2010.		1 1
	Brian S. Mitchell, an introduction to materials engineering and science for chemical and materials engineers, A JOHN WILEY & SONS, INC., New Jersey, 2004..		1
Optional literature (at the time of submission of study programme proposal)	J.I. Gersten, F.W. Smith, The Physics and Chemistry of Materials, New York, 2001;		
Quality assurance methods that ensure the acquisition of exit competences	Methods Quality assurance will be performed at three levels: (1) University; (2) Faculty Level by Quality Control Committee of teaching; (3) Level.		
Other (as the proposer wishes to add)			

Surface chemistry

NAME OF THE COURSE	Surface Chemistry					
Code	KTI104	Year of study	1st year of graduate study			
Course teacher	PhD, Zoran Grubač, prof.	Credits (ECTS)	6			
Associate teachers		Type of instruction (number of hours)	L	S	E	F
			30	15	30	
Status of the course	Election	Percentage of application of e-learning				

COURSE DESCRIPTION	
Course objectives	Deepen the knowledge of a structure of metallic surfaces, adsorption molecules on surfaces and surface analytical techniques.
Course enrolment requirements and entry competences required for the course	
Learning outcomes expected at the level of the course (4 to 10 learning outcomes)	After the course students will be able to: • Describe the structure of metallic surfaces • Define crystalline systems • Determine the symmetry of unit cell • Describe the crystal plane using Miller indices and derive the plane spacing • Conduct complex experiments in the laboratory and interpret collected data and results of measurement • Change the properties of the surface by conducting experiments
Course content broken down in detail by weekly class schedule (syllabus)	Structure of Metallic Surfaces, Adsorption of Molecules on Surfaces, The Langmuir Isotherm, Surface Analytical Techniques, Overlayer Structures & Surface Diffraction; Surface Imaging & Depth Profiling <u>Lectures:</u> 1. The structure of metal surfaces. Unit cell. Crystal systems 2. Symmetry. Symmetry of the unit cell. 3. Lattice planes and Miler indices. The distance between the planes. X-ray diffraction from crystals. 4. Inorganic crystal structures. Hexagonal close packing. Cubic dense packing. 5. ccp, fcc, bcc; Positional coordinates, Bond lengths, sizes of interstitials. 6. The structure of the surface of fcc metals. The structure of the surface hcp metals. 7. Energy of solid surfaces. Relaxation and reconstruction of the surfaces. 8. Molecular adsorption. The curve of potential energy - energy of adsorption. 9. Nucleation, formation and growth of new phase 10. Langmuir adsorption isotherm, ultrahigh vacuum. 11. Methods of preparation and characterization of surfaces I. 12. Methods of preparation and characterization of surfaces II. <u>Seminars:</u> 1. Unit cell. Calculations with unit cells 2. Miler indices. Drawing surfaces if Miler indices are known. Determination the Miler indices for a known plane. 3. Positional coordinates. Calculate the length of the bond. 4. The structure of the surface of hcp metals 5. Molecular adsorption. Adsorption kinetics. 6. 2D and 3D nucleation. Determination of the number of nuclei. <u>Laboratory exercises:</u>

	1. Development of electrodes for electrochemical measurements 2. Determination of the real surface area of the electrode - assessment criteria or reversibility of reaction of Fe2 + / Fe3 + at different electrodes. 3. Determination of the real surface area of the electrode - estimation by using electrochemical impedance spectroscopy 4. Potentiostatic formation of oxide / hydroxide film on the electrodes of the magnesium in borate electrolyte with mathematical analysis. 5. Analysis of potentiostatic transients for 2D and 3D nucleation.

Format of instruction	x lectures x seminars and workshops x exercises ☐ *on line* in entirety ☐ partial e-learning ☐0 field work	☐ independent assignments ☐ multimedia x laboratory ☐ work with mentor ☐ (other)
Student responsibilities	The 80% presence at lectures and seminars, and completed all laboratory exercises.	

Screening student work *(name the proportion of ECTS credits for each activity so that the total number of ECTS credits is equal to the ECTS value of the course)*						
	Class attendance	2	Research		Practical training	
	Experimental work	2	Report		(Other)	
	Essay		Seminar essay		(Other)	
	Tests		Oral exam	1	(Other)	
	Written exam	1	Project		(Other)	

Grading and evaluating student work in class and at the final exam	Prior to joining the laboratory exercises, students' knowledge of the material concerned exercises will be verified by tests. All exercises must be completed. Students who obtain a signature from the course Surface Chemistry can take the exam. The exam consists of a written and oral examination. The student approached the oral exam must first pass a written examination. The written part of the exam lasts two hours. The written part of the exam is evaluated as follows : Exactly solved more than 55 % - sufficient Exactly solved more than 70 % - good Exactly solved more than 80 % - very good Exactly solved more than 90 % - excellent After the written exam on the notice board of the Department will be advertised results of the exam and time when students which did not pass the written exam can view tasks and schedule for oral examinations for students which have acquired this right. A complete examination or part thereof may be installed through two partial tests during the semester. The tests cover material presented in lectures, seminars and exercises. Written tests are evaluated in the following manner: Exactly solved more than 55 % - released a written exam Exactly solved by 60 % - freed written and oral - sufficient Exactly solved by 70 % - freed written and oral - good Exactly solved by 80 % - freed written and oral - very good Exactly solved by 90 % - freed written and oral - excellent It is necessary to pass all tests in order to pass the exam. Students who did not meet any of the tests must take written and oral exam of that part.

Required literature (available in the library and via other media)	**Title**	**Number of copies in the library**	**Availability via other media**
	G.A. Somorjai, Introduction to Surface Chemistry		

	and Catalysis, Wiley-Interscience, New York, 1994..		
	K. Christmann, Introduction to Surface Physical Chemistry, Springer-Verlag, New York, 1991.		
	Zoran Grubač: „Predavanja iz Kemije površina“		web http://www.ktf-split.hr
Optional literature (at the time of submission of study programme proposal)	P.W. Atkins and J. de Paula, Physical Chemistry, 7th Ed., Freeman, NewYork, 2002.; A. W. Adamson and A. P. Gast, Physical Chemistry of Surfaces, 6th Ed., Wiley-Interscience, New York, 1997.		
Quality assurance methods that ensure the acquisition of exit competences	- Information from interviews, observations, and consultation with students during lectures - Student survey		
Other (as the proposer wishes to add)			

Methods of separation and speciation

NAME OF THE COURSE	Methods of separation and speciation					
Code	KTI101	Year of study	1			
Course teacher	PhD, Josipa Giljanović, associat prof.	Credits (ECTS)	6,0			
Associate teachers		Type of instruction (number of hours)	L	S	E	F
			30	15	30	0
Status of the course	Elective	Percentage of application of e-learning				
COURSE DESCRIPTION						
Course objectives						
Course enrolment requirements and entry competences required for the course	Completing the course: General Chemistry					
Learning outcomes expected at the level of the course (4 to 10 learning outcomes)	1. Adoption of fundamental knowledge about the species and speciation analysis 2. Understand and apply the methods of sample preparation for analysis of species 3. Implement the instrumental methods in the analysis of complex species sample. 4. Implement the principles of validation of the analytical method in the analysis of species					
Course content broken down in detail by weekly class schedule (syllabus)	1. Week: Analytical system. Sampling processing samples for analysis species. Seminar: Solving numerical examples treated theoretical material. 2. Week: Preparation of the sample for analysis species, validation, measurement uncertainty for sampling Seminar: Solving problems. 3. week: The importance and definition of speciation., Structural areas of speciation, isotopic composition, electronic and oxidation states. Seminar: Solving problems 4. Week: speciation of inorganic and organic compounds and complexes, organometallic compounds, speciation macromolecular compounds. Seminar: Solving problems 5. Week: Methodology specijacijske analysis. Seminar: Solving problems 6. week: Methods and techniques for speciation analysis and application. Seminar: Solving problems 7. Week 1.parcijalni test, solving test 8. week: The standard methods and reference materials, validation. Seminar: Solving problems 9. week: Application spectrometry as a detection system in the analysis of species. Seminar: Solving problems 10. week: Validation of spectroscopic methods and anliza species. Seminar: Solving problems 11. Week: Ion-selective electrode application in the analysis of species. Seminar: Solving problems 12. Week: Analysis of speciation, an example from the environment. Seminar: Solving problems 13 Week. Analysis of speciation, examples of analyzes of food. Seminar: Solving problems 14. Week: flow-injection method, an example of an analysis of species. An automated analytical systems. Seminar: Solving problems					

<table>
<tr><td></td><td colspan="6">15th week: Examination (II. Partial test theoretical and seminar materials). Solving test
List of exercises:
1. Gravimetric determination of iron species
2. Spectrophotometric determination of iron species
3. Gravimetric determination of chromium species
4. Spectrophotometric determination of chromium species
5. Determination of EDTA species</td></tr>
<tr><td>Format of instruction</td><td colspan="3">☒ lectures
☒ seminars and workshops
☒ exercises
□on linein entirety
□partial e-learning
□field work</td><td colspan="3">□independent assignments
☒ multimedia
☒ laboratory
□work with mentor
□ (other)</td></tr>
<tr><td>Studentresponsibilities</td><td colspan="6">Lectures attendance - at least 80% and completing exercises</td></tr>
<tr><td rowspan="6">Screening student work(name the proportion of ECTS credits for eachactivity so that the total number of ECTS credits is equal to the ECTS value of the course)</td><td>Class attendance</td><td>0,5</td><td>Research</td><td></td><td>Practical training</td><td></td></tr>
<tr><td>Experimental work</td><td></td><td>Report</td><td></td><td>Laboratory Exercises</td><td>1,5</td></tr>
<tr><td>Essay</td><td></td><td>Seminar essay</td><td>1,5</td><td>(Other)</td><td></td></tr>
<tr><td>Tests</td><td></td><td>Oral exam</td><td>1</td><td>(Other)</td><td></td></tr>
<tr><td>Written exam</td><td>1</td><td>Project</td><td>1</td><td>(Other)</td><td></td></tr>
<tr><td colspan="6"></td></tr>
<tr><td>Grading and evaluating student work in class and at the final exam</td><td colspan="6">The entire test can be applied over two partial tests during the semester. Passing threshold is 60%. Each test in assessing participates with 50%. Lectures presence of 80 to 100% is 10% marks. The examination periods there is a written and oral exam. Passing threshold is 60%. Passing one partial test of any part (previous activity) is valid throughout current academic year. Written exam has a share of 50% and oral examination also 50%. Students who have not passed the partial tests will have oral examination in the regular examination period. Passing threshold is 60% and the examination form to participate in the evaluation by 50%.

Rating: 60% -69% - satisfactory, 70% -79% - good, 80% -89% very good, 90% - 100% - excellent.</td></tr>
<tr><td rowspan="3">Required literature (available in the library and 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">1. D. A.Skoog, D. M. West, F. J. Holler, Fundamentals of Analytical Chemistry, Seventh Edition, Saunders College Publishing, New York, London, 1996. { šesto izdanje (englesko) 1992, prvo izdanje (hrvatsko), Školska knjiga, Zagreb, 1999.};</td><td>1.</td><td colspan="2">Web page of the Department of Analytical Chemistry</td></tr>
<tr><td colspan="3">2.A. Skoog, D. M. West i F. J. Holler, S. R. Crouch, Fundamentals of Analytical Chemistry, 9th edition, Brooks&Cole, SAD, 2014.; 3.D.C.Harris, Quantitative Chemical Analysis, Eighth Edition, W.H.Freeman and Company, New York, 2010.</td><td>6</td><td colspan="2"></td></tr>
</table>

	. R. Cornelis et al. Handbook of Elemental Speciation: Techniques and Methodology, Book News, Portland, 2004.	1	
Optional literature (at the time of submission of study programme proposal)			
Quality assurance methods that ensure the acquisition of exit competences	• registration of student's presence in class • annual analysis of students success in this course • student's survey in order to evaluate the professor • professor's self-evaluation		
Other (as the proposer wishes to add)			

Physical methods of analysis

NAME OF THE COURSE	Physical methods of analysis					
Code	KTH102	Year of study	1			
Course teacher	PhD. Josipa Giljanović, associat prof.	Credits (ECTS)	6			
Associate teachers		Type of instruction (number of hours)	L	S	E	F
			30	15	30	0
Status of the course	Elective	Percentage of application of e-learning				
COURSE DESCRIPTION						
Course objectives	Acquisition of basic knowledge about the physical methods of analysis based on optical and electrochemical phenomena. To enable students to understand and apply the acquired knowledge in practice in the analysis of complex samples					
Course enrolment requirements and entry competences required for the course	Completed appropriate undergraduate study					
Learning outcomes expected at the level of the course (4 to 10 learning outcomes)	1. Adoption of the basic knowledge and principles of the application of spectroscopic techniques for analysis of complex samples 2. Understand and apply the methods of sample preparation for chemical analysis 3. Apply spectroscopic analysis methods in the analysis of complex samples. 4. Implement separation analysis methods in the analysis of complex samples. 5. Apply the principles of validation of the analytical method					
Course content broken down in detail by weekly class schedule (syllabus)	1. week: Analytical system. Sampling from the environment. Seminar: Solving problems. 2. Week: Preparation of the sample for analysis. Seminar: Solving problems. 3. week: Method of isolation of the analyte from the nuts: solid phase extraction, microwave ultrasonic extraction. Seminar: Solving problems. 4. Week: Spectroscopic methods. Molecular Spectroscopy. Seminar: Solving problems. 5. Week: Atomic absorption spectroscopy, mass spectroscopy. Seminar: Solving problems. 6. week: Chromatographic methods: gas, ion, thin layer chromatography. Seminar: Solving problems. 7. Week : 1st. partial exam, solving the test 8. week: High performance liquid chromatography. Seminar: Solving problems. 9. week: Validation of methods. Comparison of methods. The choice of the appropriate method. Seminar: Solving problems 10. Week: Statistical analysis and evaluation of results, and obtain information about the sample. Seminar: Solving problems					

<table>
<tr><td></td><td colspan="6">11. Week: Validation of spectoscopic methods, examples. Seminar: Solving problems

12.Validation of chromatographic methods examples. Seminar: Solving problems

13 Week: Automation in the analytical laboratory. Segmented flow method. Seminar: Solving problems

14. Week: flow-injection method. An automated analytical systems. Seminar: Solving problems

15. Week : 2 nd partial exam , solving the test</td></tr>
<tr><td>Format of instruction</td><td colspan="3">☒ lectures
☒ seminars and workshops
☒ exercises
□on linein entirety
□partial e-learning
□field work</td><td colspan="3">□independent assignments
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☒ laboratory
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□ (other)</td></tr>
<tr><td>Studentresponsibilities</td><td colspan="6">Lectures attendance - at least 80% and completing exercises</td></tr>
<tr><td rowspan="6">Screening student work(name the proportion of ECTS credits for eachactivity so that the total number of ECTS credits is equal to the ECTS value of the course)</td><td>Class attendance</td><td>0,5</td><td>Research</td><td></td><td>Practical training</td><td></td></tr>
<tr><td>Experimental work</td><td></td><td>Report</td><td></td><td>Laboratory Exercises</td><td>2,5</td></tr>
<tr><td>Essay</td><td></td><td>Seminar essay</td><td>1,5</td><td>(Other)</td><td></td></tr>
<tr><td>Tests</td><td></td><td>Oral exam</td><td>1</td><td>(Other)</td><td></td></tr>
<tr><td>Written exam</td><td>1</td><td>Project</td><td>1</td><td>(Other)</td><td></td></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Grading and evaluating student work in class and at the final exam</td><td colspan="6">The entire test can be applied over two partial tests during the semester. Passing threshold is 60%. Each test in assessing participates with 50%. Lectures presence of 80 to 100% is 10% marks. The examination periods there is a written and oral exam. Passing threshold is 60%. Passing one partial test of any part (previous activity) is valid throughout current academic year. Written exam has a share of 50% and oral examination also 50%. Students who have not passed the partial tests will have oral examination in the regular examination period. Passing threshold is 60% and the examination form to participate in the evaluation by 50%.

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2.A. Skoog, D. M. West i F. J. Holler, S. R. Crouch, Fundamentals of Analytical Chemistry, 9th edition,</td><td>1. 6</td><td>Web page of the Department of Analytical Chemistry</td></tr>
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</table>

	Brooks&Cole, SAD, 2014.; 3.D.C.Harris, Quantitative Chemical Analysis, Eighth Edition, W.H.Freeman and Company, New York, 2010.		
Optional literature (at the time of submission of study programme proposal)			
Quality assurance methods that ensure the acquisition of exit competences	• registration of student's presence in class • annual analysis of students success in this course • student's survey in order to evaluate the professor • professor's self-evaluation		
List of laboratory excersise	1. Determination of amount ash in flour 2. Determination of phosphorus in ash flour 3. Determination of pKa acid-base indicators 4. Determination of composition of the complex compound iron (III) sulfosalicylic acid		
Other (as the proposer wishes to add)			

Analytical environmental chemistry

NAME OF THE COURSE	Analytical Environmental Chemistry					
Code	KTH211	Year of study	2st year of graduate study			
Course teacher	PhD, Marija Bralić, associate prof.	Credits (ECTS)	6.0			
Associate teachers	PhD, Maša Buljac, assistant prof.	Type of instruction (number of hours)	L	S	E	F
			30	15	30	
Status of the course	Optional	Percentage of application of e-learning				
COURSE DESCRIPTION						
Course objectives	The basic objective of the course is the application of analytical methods and techniques in environmental analysis.					
Course enrolment requirements and entry competences required for the course	Gateways must have a good basic knowledge of analytical chemistry, physical chemistry, organic chemistry, but are not necessary to master the material..					
Learning outcomes expected at the level of the course (4 to 10 learning outcomes)	After course students will be able to : 1. to know and explain the interactions that occur between different phases in the environment (water-to-air, ground-to-air, water-soil) 2. independently sampling plan (accidentally uozkovanje, stratified sampling, systematic sampling, intuitive sampling) 3. to sample (air, water, soil, sediment and biological samples). 4. prepare samples for analysis, use of modern methods of sample preparation 5. Use a variety of techniques for environmental analysis (classical methods, instrumental methods, the technique, other techniques. 6. exert biological control (environmental indicators, biomarkers) 7. process the results of analysis					
Course content broken down in detail by weekly class schedule (syllabus)	**Lecture 1:** Introduction - environmental science and environmental analytical chemistry **Lecture 2:** Chemical Principles in the environment. Sampling from the environment **Lecture 3:** analytical separation, sample preparation for analysis **Seminar 1 (2 hours):** interpretation and data processing. Standard deviations, errors **Lecture 4:** The application of analytical methods and techniques in environmental analysis. Elektoroanalytical methods (potentiometry) **Seminar 2 (2 hours):** Quantitatively the composition of solutions - expressing concentration **Lab course 1 (5 hours):** Potentiometric determination of fluoride and chloride. Determination of iron in drinking water. **Lecture 5:** Voltammetry, coulometry **Seminar 3 (2 hours):** Calculating the pH of water of different composition and nature (sea, river, rain) **Lab course 2 (5 hours):** Determination of the pH of various types of water (river, rain) **Lecture 6:** Conductometry, spectrometric techniques **Lecture 7:** Absorption Spectrometry, induced absorption spectrometry, emission spectrometry					

<table>
<tr><td></td><td colspan="6">Lab course 3 (5 hours): Determining the concentration of transition metal in the pure aqueous solutions of UV-VIS spectrophotometry
Lecture 8: Instrumental separation techniques, gas chromatography
Seminar 4 (2 hours): Calculations data spectrometric measurements
Lab course 4 (5 hours): Determination of nitrate, nitrite and ammonium in wastewater by spectrophotometry
Lecture 9:. Liquid chromatography, the state and development of chromatographic techniques
Seminar 5 (2 hours): Calculations of trace metals in the environment
Lecture 10: Other techniques (thermal techniques, radiochemical techniques)
Seminar 6 (2 hours): The calculation of the concentration of particulate matter in the environment and display the result
Lab course 5 (5 hours): Determination of phosphorus in the solid plant
Lecture 11: Trace elements in the environment: natural level and chemical form of pollution
Seminar 7 (2 hours): Statistical analysis of the results of the analysis of environmental samples (air, water, soil)
Lecture 12: Determination of trace organic compounds
Lecture 13: Biological indicators and methods
Lecture 14: The radiation and radioactivity in the environment. contamination of soil
Lab course 6 (5 hours): Voltammetric determination of ascorbic acid in multivitamins
Lecture 15: Evaluation and interpretation of analytical data from the environment. specific applications
Seminar 8 (1 hour): Correlations (Spearman, Pearson,)</td></tr>
<tr><td>Format of instruction</td><td colspan="3">×lectures
×seminars and workshops
×exercises
□on linein entirety
□partial e-learning
□field work</td><td colspan="3">□independent assignments
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<tr><td>Essay</td><td></td><td>Seminar essay</td><td>0.5</td><td>(Other)</td><td></td></tr>
<tr><td>Tests</td><td>0.5</td><td>Oral exam</td><td>2</td><td>(Other)</td><td></td></tr>
<tr><td>Written exam</td><td>1</td><td>Project</td><td></td><td>(Other)</td><td></td></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Grading and evaluating student work in class and at the final exam</td><td colspan="6">During the semester, the two partial test to check if the knowledge of students from courses included material. During the semester students will be selected from the lecture topic to make a seminar that will affect the final grade. After completion of the semester, students take a written exam courses included material from the seminar. If the student meets at one of the partial tests during the semester, material from passing the test does not need to take the written exam. After passing the written part of the exam, the oral exam. Prior to joining the laboratory exercises, students' knowledge of material from the respective exercise will be verified by tests. All exercises must be passed all preliminary exams and completed. The student has the right to exercise fail one exercise, but you will catch up at the end of</td></tr>
</table>

<table>
<tr><td></td><td colspan="3">the semester. For all aspects of teaching evaluation will be conducted according to the following criteria: <55% inadequate; 55% -65% is sufficient; 66% -75% good; 76% -85% very good;> 86% excellent. The final grade will be the arithmetic average of ratings from exercises, written assessment and oral examination.</td></tr>
<tr><td rowspan="5">Required literature (available in the library and via other media)</td><td>Title</td><td>Number of copies in the library</td><td>Availability via other media</td></tr>
<tr><td>D. Ašperger et al, Analitika okoliša, HINUS&FKIT, Zagreb 2013.</td><td></td><td>1</td></tr>
<tr><td>E. P. Popek Sampling and analysis of environmental chemical pollutants, AP, 2003.</td><td></td><td>1</td></tr>
<tr><td>Vježbe iz Analitičke kemije okoliša (interna skripta u pripremi), Kemijsko-tehnološki fakultet, Split, 201X</td><td></td><td>1</td></tr>
<tr><td>F.W. Fifield, P.J. Haines, Environmental Analytical Chemistry, Blackie academic& professional, London, 1996</td><td></td><td>1</td></tr>
<tr><td>Optional literature (at the time of submission of study programme proposal)</td><td colspan="3">C.E. Kupchella, M. C. Hyland, Enviromental science, Massachusetts, 1989</td></tr>
<tr><td>Quality assurance methods that ensure the acquisition of exit competences</td><td colspan="3">Methods Quality assurance will be performed at three levels: (1) University; (2) Faculty Level by Quality Control Committee of teaching; (3) Level.</td></tr>
<tr><td>Other (as the proposer wishes to add)</td><td colspan="3"></td></tr>
</table>

Energy and development

COURSE NAME	ENERGY AND DEVELOPMENT					
Course code	KTC217	Year of study	2nd Academic Graduate Study			
Course lecturer	PhD, Mirko Marušić, lecturer	Credits (ECTS)	2.0			
Assistants		Type of instruction	L	S	E	F
			30	0	0	0
Course status	Elective	Application of e-learning (percentage)				
COURSE DESCRIPTION						
Course objectives	Obtaining basic theoretical knowledge in the field of energetics. Introduction to basic information needed for active participation in classes in the field of termotechnics and energetics.					
Course enrolment requirements and entry competences required for the course	none					
Learning outcomes expected at the level of the course (4 to 10 learning outcomes)	- Describing the ways of energy conversion and comparing conventional energy sources. - Describing the ways in which electricity can be produced. - Describing the ways in which nuclear energy can be used and analyizing the operation of a nuclear power plant. - Defining and describing the types of renewable energy sources. - Describing the basic characteristics of water energy usage. - Describing the ways in energy of the sun can be used and its basic characteristics. - Describing the basic characteristics of the usage of wind energy. - Describing the ways in which geotermal energy and biomass energy can be used, as well as their basic characteristics. - Defining and describing the basic elements of energetic planning and energetic policy.					
Course content broken down in detail by weekly class schedule (syllabus)	- 1st week: Energy: definition and units, energy inflow the on Earth, Earth's energy balance - energy crises, enegy resources, energy supplays, energy conversion and heat. - 2nd week: Consumption of energy; historical development, regional consumption, influence on the life quality, consumption and saving of energy in basic sectors (industry, traffic, households), estimation of global energetics development. - 3rd week: Energy of fossil fuels: coal. - 4th week: Energy of fossil fuels: oil. - 5th week: Energy of fossil fuels: natural gas. Partial assessment (1st preliminary test) - 6th week: Thermal power plant, influence on environmente (greenhouse effects, acid rains, particulates, heat contamination), exploitation of waste heat, magnetohydrodynamic generators. - 7th week: Hydroenergy: basic characteristics of water flow, hydro-electric power plants.					

<table>
<tr><td></td><td colspan="6">- 8th week: Nuclear energy: fission.
- 9th week: Nuclear reactors.
- 10th week: Nuclear fuels. Partial assessment (2nd preliminary test)
- 11th week: Nuclear fusion, projects of fusion devices.
- 12th week: Influence of nuclear energy on mankind and environmente.
- 13th week: Solar energy: conversion in heat energy (active and passive solar systems, solar furnaces, solar-electric power plants), photovoltaic conversion (photovoltaicells and photovoltaic systems), application of nanotechnology, bioconversion (cultivation and energetical exploitation of biomass).
- 14th week: Wind energy: basic characteristics, wind turbines, wind-electric power plants.
- 15th week: Energy of oceans and seas: energy of high and low tide, energy of waves, heat energy. Geothermal energy: hydrogeothermal and petrogeothermal energy supplays, influence on environmente. Storage of energy. Partial assessment (3nd preliminary test).</td></tr>
<tr><td>Format of instruction</td><td colspan="3">X lectures
☐ seminars and workshops
☐exercises
☐ on line in entirety
☐ partial e-learning
X field work</td><td colspan="3">☐ independent assignments
X multimedia
☐laboratory
☐ work with mentor
X group and individual tutorials
☐seminars</td></tr>
<tr><td>Student responsibilities</td><td colspan="6"></td></tr>
<tr><td rowspan="6">Screening student work (name the proportion of ECTS credits for each activity so that the total number of ECTS credits is equal to the ECTS value of the course)</td><td>Class attendance</td><td>0.5</td><td>Research</td><td></td><td>Practical training</td><td></td></tr>
<tr><td>Experimental work</td><td></td><td>Report</td><td></td><td>Pre-test preparation classes</td><td></td></tr>
<tr><td>Essay</td><td></td><td>Seminar essay</td><td></td><td>(Other)</td><td></td></tr>
<tr><td>Tests</td><td>0.5</td><td>Oral exam</td><td>0.5</td><td>(Other)</td><td></td></tr>
<tr><td>Written exam</td><td>0.5</td><td>Project</td><td></td><td>(Other)</td><td></td></tr>
<tr><td></td><td colspan="5"></td></tr>
<tr><td>Grading and evaluating student work in class and at the final exam</td><td colspan="6">In course of the semester, the entire exam can be passes by taking and passing the three preliminary tests consisting of theoretical questions.
In the examination periods oral exam is taken.
Grades: 55-64% - sufficient; 65-79% - good, 80-89% - very good; 90-100% - excellent.</td></tr>
<tr><td rowspan="4">Required literature (available in the library and via other media)</td><td colspan="3">Book title</td><td>Number of books in the library</td><td colspan="2">Available via other media</td></tr>
<tr><td colspan="3">Internal script</td><td></td><td colspan="2">Web portal</td></tr>
<tr><td colspan="3"></td><td></td><td colspan="2">-</td></tr>
<tr><td colspan="3"></td><td></td><td colspan="2">-</td></tr>
<tr><td>Optional literature</td><td colspan="6">D. Krpan-Lisica, Osnove energetike, Hinus, Zagreb, 2001.
C.J. Cleveland, Editor, Encyclopedia of Energy, Vol.1-6, Elsevier, San Diego 2004.
H. Požar, Osnove energetike 1,2, Školska knjiga, Zagreb, 1992.
V. Knapp, Novi izvori energije 1, Školska knjiga, Zagareb, 1993.
P. Kulišić, Novi izvori energije 2, Školska knjiga, Zagreb, 1991.</td></tr>
</table>

Quality assurance methods that ensure the acquisition of exit competences	Quality assurance will be performed at three levels: (1) University Level; (2) Faculty Level by Quality Control Committee; (3) Lecturer's Level.
Other (as the proposer wishes to add)	

Environmental Chemistry

Physical chemistry of electrolyte solutions

NAME OF THE COURSE	Physical chemistry of electrolyte solutions					
Code	KTH101	Year of study	1.			
Course teacher	PhD, Vesna Sokol, assistant prof.	Credits (ECTS)	7.5			
Associate teachers		Type of instruction (number of hours)	L	S	E	F
			30	15	30	
Status of the course	Mandatory	Percentage of application of e-learning				
COURSE DESCRIPTION						
Course objectives	The aim of the course is a systematic review and extension of basic knowledge of structural, thermodynamic and transport properties of electrolyte solutions derived from lectures in physical chemistry.					
Course enrolment requirements and entry competences required for the course						
Learning outcomes expected at the level of the course (4 to 10 learning outcomes)	Upon successful completion of the program, students will be able to: 1) explain the main characteristic whereby electrolytes are distinguished from other solutions, 2) apply the thermodynamic quantities for the treatment of equilibrium conditions, 3) explain the different conductivity chemical models, 4) understand the theoretical treatment of transport properties based on the interionic attraction theory of Debye and Huckel 5) independently determine the equilibrium constant for the reaction of ionic associations, 6) interpret the experimental and theoretical data.					
Course content broken down in detail by weekly class schedule (syllabus)	<u>Lectures</u> 1st week: Introduction. Classification of solvents and electrolytes. Non-electrostatic interactions. Triple-ion formation. 2nd week: Spectroscopic studies of association. Ionizing solvation reactions. Thermodynamic energy functions and their variables. The chemical potential of electrolytes in solutions. 3rd week: Partial molar quantities. Attractive potentials of spatially fixed ions and dipoles. Van der Waals potential. Ions and molecules in homogeneous dielectric media. 4th week: Dipole molecule in a homogeneous dielectric medium. Reaction field. Complete ion-ion interaction potentials in solutions. 5th week: Particle size parameters (solvent molecules, inorganic and organic ions). Ions and molecules in the gas phase, (gas phase equilibria of electrolytes, ion clustering by solvent molecules. Ion solvation in the liquid phase. Extrapolation methods and extrathermodynamic assumptions. 6th week: Examples of solvation studies. Diffusion (measuring methods, self-diffusion, coupled diffusion. 7th week: Charge transport. Single ion conductivities. Empirical investigation on electrolyte conductivity. Viscosity. Dielectric polarization. 8th week: Static permittivity. Measurement of high-frequency permittivity. Phenomenological aspects. Relaxation processes of pure liquids and their mixtures. 9th week: Relaxation spectra of electrolyte solutions (solvent and ion pairs					

<table>
<tr><td></td><td colspan="6">relaxation). Dielectric decrement. Solvent relaxation time. Distribution and correlation functions.
10th week: Chemical model at low electrolyte concentrations – lcCM. The mean force potential, the activity coefficient of the lcCM, the ion pair concept of the lcCM.
11th week: Properties of electrolyte solutions at the lcCM. Measurement of the solvent activity. Activity coefficients and osmotic coefficients.
12th week: Experimental osmotic coefficients. Fitting equations for osmotic and activity coefficient. Pitzer equations, extended lcCM equation. Partial molar enthalpy.
13th week: Chemical kinetics as a test for chemical models on the MM level. Primary kinetic salt effect.
14th week: Solvent effects. Transport equations on the lcCM level. Hydrodynamic ion-ion interactions.
15th week: Electrophoretic term of the conductivity equation. Limiting law of conductivity.

<u>Seminars</u>
Solving numerical problems.

<u>Laboratory exercises</u>
1. Molar conductivity of symmetrical electrolytes. 2. The chemical model of conductivity. 3. Thermodynamic quantities for the association reaction. 4. Determination of stability constants of chlorocadmium complexes in water by direct potentiometry. 5. Thermodynamic study of $CdCl_2$ in water from potential difference measurements. 6. Determination of limiting transference number for sodium ion from aqueous solutions of NaCl using potentiometry method.</td></tr>
<tr><td>Format of instruction</td><td colspan="3">xlectures
xseminars and workshops
xexercises
□on linein entirety
□partial e-learning
□field work</td><td colspan="3">xindependent assignments
xmultimedia
xlaboratory
□work with mentor
□ (other)</td></tr>
<tr><td>Studentresponsibilities</td><td colspan="6">Students are required to attend classes (lectures and seminars 80%, and laboratory exercises 100%) and actively participate in the teaching process. This will be recorded and evaluated in making a final assessment.</td></tr>
<tr><td rowspan="6">Screening student work(name the proportion of ECTS credits for eachactivity so that the total number of ECTS credits is equal to the ECTS value of the course)</td><td>Class attendance</td><td>3</td><td>Research</td><td></td><td>Practical training</td><td></td></tr>
<tr><td>Experimental work</td><td>1</td><td>Report</td><td></td><td>(Other)</td><td></td></tr>
<tr><td>Essay</td><td></td><td>Seminar essay</td><td>0.5</td><td>(Other)</td><td></td></tr>
<tr><td>Tests</td><td>1</td><td>Oral exam</td><td>1</td><td>(Other)</td><td></td></tr>
<tr><td>Written exam</td><td>1</td><td>Project</td><td></td><td>(Other)</td><td></td></tr>
<tr><td colspan="6"></td></tr>
<tr><td>Grading and evaluating student work in class and at the final exam</td><td colspan="6">The course content is divided into two units that students take over partial exams or joining final exam at the end of the semester. The written exam is considered passed if students achieve at least 60%. The final grade is based on the evaluation of partial exams. Grades: <60% not satisfied, 60-69% successful (2), 70-79% good (3), 80-89% very good (4), 90-100% excellent (5)</td></tr>
<tr><td>Required literature (available in the</td><td colspan="4">Title</td><td>Number of copies in</td><td>Availability via other media</td></tr>
</table>

library and via other media)		**the library**	
	J.M.G. Barthel, H. Krienke, W. Kunz, Physical Chemistry of Electrolyte Solutions, Modern Aspects, Steinkopff, Darmstadt, 1998.	1	
	R. A. Robinson, R.H. Stokes, Electrolyte Solutions, 2nd Revised Edition, Dover Publications, 2002.	2	
Optional literature (at the time of submission of study programme proposal)	P. Atkins, J. de Paula, Atkins' Physical Chemistry, 8th Edition, Oxford University Press, Oxford 2006.		
Quality assurance methods that ensure the acquisition of exit competences	Quality of the teaching and learning, monitored at the level of the (1) teachers, accepting suggestions of students and colleagues, and (2) faculty, conducting surveys of students on teaching quality.		
Other (as the proposer wishes to add)			

Chemometrics

COURSE NAME	Chemometrics					
Code	KTH210	Godina studija	2nd			
Course teacher	PhD, Ante Prkić, assistant prof.	Bodovna vrijednost (ECTS)	7,5			
Associate teachers		Način izvođenja nastave (broj sati u semestru)	P	S	V	T
			30	45		
Status of the course	Mandatory	Postotak primjene e-učenja				
OPIS PREDMETA						
Course objectives	Introduce students to the importance of the use of mathematical and statistical methods for processing experimental data, conduct multi-variety data, and planning experiments. Allow them to work on computers and familiar with standard software packages (MS Excel, Wolfram Mathematica, MatLab, Statistica).					
Course enrolment requirements and entry competences required for the course	Completed appropriate undergraduate					
Learning outcomes expected at the level of the course (4 to 10 learning outcomes)	7. Define the data distribution. 8. Apply second statistical hypothesis tests in chemistry. 9. Use third method of exploration data on real chemical systems. 10. Know the fourth design an experimental procedure. 11. Put the methods of modeling and optimization, and extract the useful information to know. 12. Know calibrate the analytical system, process measurement signal in order to obtain useful information					
Course content broken down in detail by weekly class schedule (syllabus)	Week 1: Introduction to chemometrics. Types of experimental data. The relation between the experimental data, information and knowledge. Seminar: Basic statistical concepts in MS Excel Week 2: Basic Statistics in chemometrics. Probability. The distribution of the data. Descriptive statistics. The accuracy and precision. Seminar: Basic statistical concepts in Wolfram Mathematica Week 3: Tests hypotheses. Parametric tests. Significance tests - t-test, F-test, ANOVA test for normality of distribution. Seminar: Basic statistical concepts in Statistics Week 4: The one-factor analysis of variance. Multi-factor analysis of variance. Seminar: Significance tests in MS Excel Week 5: Experimental design and optimization. Seminar: Tests of significance in Wolfram Mathematica. Week 6: The quality of analytical measurement - assessment of variability, comparative tests, measurement uncertainty. Seminar: Tests of significance in Statistics Week 7: Regression analysis, least squares method: linear models, tests of significance of regression parameters. Seminar: Regression analysis in MS Excel 8th week: Exploratory Data Analysis. A complex pattern. Identifying the sample. Methods for identification of the sample with and without an external teacher. Rotation. Seminar: Regression analysis in Wolfram Mathematica. Week 9: Principal Component Analysis. Covariance matrix. Eigenvalues and eigenvectors. The principles of reducing the number of dimensions. Seminar: Regression analysis in statistics. 10th week: Hierarchical cluster analysis. Distance and similarity. Single, full and centroid connections. Dendrograms. Seminar: Analysis of the main components in					

<table>
<tr><td></td><td colspan="6">Wolfram Mathematica
11th week: Classification. Linear and nonlinear model of classification. Method K-nearest neighbors. Method independent modeling class analogy. Seminar: Principal Component Analysis in Statistics
12th week: Signal processing. Signal detection, limit of detection, limit choices and limit of quantification. Scaling. Filling. Averaging. Filtering. Leveling. Multi-point sampling. Fourier transformation. Modulation signal. Derivatives signal. Decompression. Seminar: Fourier Transform in Wolfram Mathematica
13th week: Optimization. The functions of the evaluation criteria. Making decisions based on multiple criteria. Pareto optimality. Derringer function. Seminar: Fourier Transform in MatLab
14th week: Algorithms for optimization. Simplex. Genetic algorithms. Basic principles, purpose and usage examples. Seminar: Linear and nonlinear models of classification in Statistics
15th week: molecular modeling. Optimization of the structure. Calculation of descriptors. Linking the physical and chemical properties of the structural properties of the molecules. Seminar: Algorithms for optimization in Statistics</td></tr>
<tr><td>Format of instruction</td><td colspan="3">x Lectures
x Seminars and workshops
x Exercise
☐on line in its entirely
x Mixed e-learning
☐Fieldwork</td><td colspan="3">x Homework
x multimedia
☐laboratory
☐Mentoring
☐ (other)</td></tr>
<tr><td>Studentresponsibilities</td><td colspan="6"></td></tr>
<tr><td rowspan="5">Screening student work(name the proportion of ECTS credits for eachactivity so that the total number of ECTS credits is equal to the ECTS value of the course)</td><td>Class attendance</td><td>0.5</td><td>Exploration</td><td></td><td>Practical work</td><td>1.0</td></tr>
<tr><td>Experimental work</td><td></td><td>Report</td><td></td><td>(Other)</td><td></td></tr>
<tr><td>Essay</td><td></td><td>Seminar</td><td>1.5</td><td>(Other)</td><td></td></tr>
<tr><td>Tests</td><td></td><td>Oral examination</td><td>1.0</td><td>(Other)</td><td></td></tr>
<tr><td>Written exam</td><td>1.0</td><td>Project</td><td>1.0</td><td>(Other)</td><td></td></tr>
<tr><td>Grading and evaluating student work in class and at the final exam</td><td colspan="6">The entire examination can be applied over the two partial test of theoretical and seminar materials during the semester. Passing threshold is 60%. Each colloquium in the assessment accounts for 50%. Lectures presence of 80 to 100% is 10% marks. The examination periods there is a written, oral and written and oral examination. Passing threshold is 60%. Passing one partial test from any part (previous activity) is valid throughout the current academic year. Written exam has a share of 30% of oral and written with 60% and 10% verbal. Students who did not pass the exam by the partial tests take the exam through written, oral and written-oral examination in the regular examination periods. Passing threshold is 60% and the examination form to participate in the assessment with 50%.
Rating: 60% -69% - satisfactory, 70% -79% - a good 80% -89% -very good, 90% -100% - excellent.</td></tr>
<tr><td>Required literature (available in the library and via other</td><td colspan="3">Title</td><td>Number of copies in the library</td><td colspan="2">Accessible via other media</td></tr>
</table>

media)	1. Paul GemeprlineEd.Practical Guide to Chemometrics, 2nd Ed. CRC Press, Taylor & FrancisG roup, 2006, Boca Raton, USA, 2006.	1	
	2. Richard G. Brereton: Chemometrics Data Analysis for the Laboratory and Chemical Plant, John Wiley & Sons Ltd, West Sussex, UK, 2003	1	
	2. Peter C. Meier,Richard E. Zund, Statistical Methods in Analytical Chemistry, 2nd Ed. John Wiley & Sons Ltd, New York, USA, 2000.	1	
	3. Ivan Šošić, Primijenjena statistika, Školska knjiga, Zagreb, Hrvatska, 2004.	1	
Optional literature (at the time of submission of study programme proposal)			
Quality assurance methods that ensure the acquisition of exit competences	• Registration of the presence of students • Annual analysis of student • Student survey		
Other (as the proposer wishes to add)			

Quantum chemistry

COURSE NAME	Quantum Chemistry					
Course code	KTH103	Year of study	1st			
Course lecturer	PhD, Magdi Lučić Lavčević, associate prof.	Credits (ECTS)	5.0			
Assistants		Type of instruction	L	S	E	F
			30	15	0	0
Course status	Mandatory	Application of e-learning (percentage)				
COURSE DESCRIPTION						
Course objectives	Introducing the students to the principles of quantum theory and application of this theory to the topics of chemistry. Establishment of modern methodologies for the theoretical study of the structure and spectra of atoms and molecules, molecular dynamics and molecular interactions.					
Course enrolment requirements and entry competences required for the course	none					
Learning outcomes expected at the level of the course (4 to 10 learning outcomes)	- Understanding of the basic principles of quantum chemistry and its role in modern chemical research - Knowledge of and ability to apply mathematical methods used in quantum chemistry - Extended theoretical knowledge needed to fully understand the physics of atoms and molecules - Ability to analyze the structure of molecules and their energy states - Mastering modern methods of quantum chemistry at the level of operational knowledge acquisition for computing structure and spectra. - Extended and an improved knowledge and understanding of interactions between molecules, the behavior of molecules in external fields and methodological approaches to research these phenomena - Drawing conclusions about developments related molecules based on the analysis of experimental data - The ability of using presented models (electronic structure of organic molecules; cages, clusters, nanomaterials and crystals; studies of polymers, proteins and drugs).					
Course content broken down in detail by weekly class schedule (syllabus)	Problems of the classical theory: stability and dimensions of atoms and molecules, photoelectric effect, black body radiation spectrum of the hydrogen atom, Bohr model of the atom. The old quantum theory. Quantum theory: the wave nature of particles, Schrodinger equation, spin, postulates. Particle in a box. Harmonic oscillator. Hydrogen atom, atomic orbitals. Spin. Multielectron atoms. Atomic spectra. Born-Oppenheimer approximation, Heitler-London's approach. Molecular orbitals. Correlation diagram. Hybridization. Huckel molecular orbitals. Electronic structure of crystals. Ligand field theory. The molecular spectra. Molecular mechanics. The interaction of molecules. The molecules in external fields. Application of presented models. Prediction of molecular properties.					
Format of instruction	**X** lectures ☐ seminars and workshops ☐ exercises ☐ *on line* in entirety ☐ partial e-learning		☐ independent assignments **X** multimedia ☐ laboratory ☐ work with mentor **X** group and individual tutorials			

<table>
<tr><td></td><td colspan="3">☐ field work</td><td colspan="3">X seminars</td></tr>
<tr><td>Student responsibilities</td><td colspan="6"></td></tr>
<tr><td rowspan="6">Screening student work (name the proportion of ECTS credits for each activity so that the total number of ECTS credits is equal to the ECTS value of the course)</td><td>Class attendance</td><td>1.0</td><td>Research</td><td></td><td>Practical training</td><td></td></tr>
<tr><td>Experimental work</td><td></td><td>Report</td><td></td><td>Pre-test preparation classes</td><td></td></tr>
<tr><td>Essay</td><td></td><td>Seminar essay</td><td>1.3</td><td>(Other)</td><td></td></tr>
<tr><td>Tests</td><td>1.4</td><td>Oral exam</td><td>1.3</td><td>(Other)</td><td></td></tr>
<tr><td>Written exam</td><td></td><td>Project</td><td></td><td>(Other)</td><td></td></tr>
<tr><td colspan="6"></td></tr>
<tr><td>Grading and evaluating student work in class and at the final exam</td><td colspan="6">During the semester, the final exam can be passed via midterm exams and seminar essays -calculations..
During the final exams period, the final exam shall be taken after presenting the seminar essays.
Grades: 55-64% - sufficient; 65-79% - good, 80-89% - very good; 90-100% - excellent.</td></tr>
<tr><td rowspan="4">Required literature (available in the library and via other media)</td><td colspan="3">Book title</td><td>Number of books in the library</td><td colspan="2">Available via other media</td></tr>
<tr><td colspan="3">Attila Szabo, Neil S. Ostlund, Modern Quantum Chemistry, Dover Publications, Mineola, NY, 1996;</td><td>1 coming soon</td><td colspan="2">-</td></tr>
<tr><td colspan="3">N. Trinajstić, Molekularne orbitale u kemiji, Suvremena kemija, Školska knjiga, Zagreb, 1974;</td><td>4</td><td colspan="2">-</td></tr>
<tr><td colspan="3"></td><td></td><td colspan="2">-</td></tr>
<tr><td>Optional literature</td><td colspan="6">W.G. Richards, J.A. Horstley, Ab initio Molecular Orbital Calculations for Chemists, Clarendon Press, Oxford, 1970.

A. Graovac, I. Gutman, N. Trinajstić, Topological Approach to the Chemistry of Conjugated Molecules, Springer, Berlin, 1977.</td></tr>
<tr><td>Quality assurance methods that ensure the acquisition of exit competences</td><td colspan="6">Quality assurance will be performed at three levels:
(1) University Level; (2) Faculty Level by Quality Control Committee; (3) Lecturer’s Level.</td></tr>
<tr><td>Other (as the proposer wishes to add)</td><td colspan="6"></td></tr>
</table>

Organic analysis

<table>
<tr><td colspan="2">NAME OF THE COURSE</td><td colspan="6">Organic Analysis</td></tr>
<tr><td>Code</td><td>KTH104</td><td>Year of study</td><td colspan="5">1</td></tr>
<tr><td>Course teacher</td><td>PhD, Ivica Blažević, assistant prof.</td><td>Credits (ECTS)</td><td colspan="5">10,0</td></tr>
<tr><td rowspan="2">Associate teachers</td><td rowspan="2"></td><td rowspan="2">Type of instruction (number of hours)</td><td>L</td><td>S</td><td>E</td><td colspan="2">F</td></tr>
<tr><td>30</td><td>15</td><td>60</td><td colspan="2">0</td></tr>
<tr><td>Status of the course</td><td>Mandatory</td><td>Percentage of application of e-learning</td><td colspan="5"></td></tr>
<tr><td colspan="8">COURSE DESCRIPTION</td></tr>
<tr><td>Course objectives</td><td colspan="7">The aim is to teach students the methods for isolation, purification and identification of diferent organic compounds classess by interpreting spectra obtained by modern spectroscopic techniques.</td></tr>
<tr><td>Course enrolment requirements and entry competences required for the course</td><td colspan="7">Organic chemistry</td></tr>
<tr><td>Learning outcomes expected at the level of the course (4 to 10 learning outcomes)</td><td colspan="7">After completing the course, the student will become familiarized with the major concepts of organic analysis, which includes:
• isolating different classes of organic compounds from complex mixtures
• selection of appropriate spectroscopic methods
• combining individual spectroscopic methods for structure elucidation;
• the use of spectroscopic methods to monitor the reaction process;
• application of acquired knowledge in research projects.</td></tr>
<tr><td>Course content broken down in detail by weekly class schedule (syllabus)</td><td colspan="7">➢ Lectures and seminars (L+S):
5. Classical methods of analysis. (12 + 4)
Biological samples. Reaction products. Commercial samples. Processing of the sample, isolation and concentration. Separation based on solubility, volatility, and the acid-base properties. Separation of the enantiomers. Polarimetry.
6. Chromatographic separation (TLC, GC, HPLC). (1 + 0)
7. Molecular formulas and what can be learned from them? (0.5 + 1)
Molecular formulas. Index of hydrogen deficiency. The rule of thirteen.
I. Partial exam (written, 1hour and 30 min)
8. Spectroscopy analysis methods. (0.5 + 0)
Spectroscopic techniques used in organic compound structure elucidation.
5. Mass spectrometry (MS). (3 + 1.5)
Theory, instrumentation, and techniques. Isotopic masses. Isotopic abundances, and high-resolution mass spectrometry (HRMS). Fragmentation in EIMS: influence of functional groups on fragmentation. Examples of different classes of organic compounds.
6. Ultraviolet and visible spectroscopy (UV/Vis) (3 + 1)
Electromagnetic spectra. The nature of electronic excitations. The origin of UV band structure. Principles of absorption spectroscopy. Presentation of spectra. Solvents. What is a chromophore. Effect of conjugation. What to look for in ultraviolet spectra. Examples of different classes of organic compounds.
7. Infrared spectroscopy (IR) (4 + 1.5)
Introduction, Theory, instrumentation, and sample preparation. C,H,O-containing functional groups. Effect of ring size, conjugation and electron-withdrawing groups. Examples of different classes of organic compounds.</td></tr>
</table>

<table>
<tr><td></td><td colspan="6">8. Nuclear magnetic resonance spectroscopy (NMR). (6 + 2)
Basic concepts. ^{1}H NMR Chemical shifts. Spin-Spin Coupling. Magnetic anizotropy. ^{13}C NMR Chemical shifts. Aromatic compounds – substituted benzene rings. Homotopic, enantiotopic, and diastereotopic systems. 2D NMR spectroscopy. Examples of different classes of organic compounds.
9. Combined structure problems (0 + 4)
II. Partial exam (written, 2 hours)
III. Partial exam (oral, 30 min)

➢ Laboratory exercises (E)
1. Separation of the water-insoluble mixtures. (5)
2. Separation of the water-soluble mixtures. (5)
3. Racemic mixture. Isolating the enantiomers of 1-phenylethylamine by fractional crystalization. Measuring the rotation of plane-polarized light by polarimeter. (7)
4. Tests for determination of the functional groups of separated compounds. (5)
5. Influence of inter- and intra-hydrogen bonds on melting point: Determination of the melting point on the aluminum block. (2)
6. UV/VIS absorption spectroscopy. Bathochromic shift: recording absorption spectra (benzene, aniline, phenol, benzoic acid, cinnamic acid, ferulic acid) and determination of auxochrome effect (-OH, -NH_2, - OCH_3) and conjugation on absorption maximum, λ_{max}. (4)
7. Recording absorption spectra and investigation of the influence of pH on the absorption bands of phenol and aniline. Study of the connection between molecular structure and absorption maxima: spectral acid-base indicators phenolphtalein and thymol blue in acidic and basic media. (4)
8. Hypsochromic effect of auxochrome on n→ π* transition of carbonyl group: Recording spectra of acetone and ethyl-acetate. (4)
9. Effect of solvent on the appearance of absorption band: the recording of UV spectra of phenol in ethanol and hexane. Influence of solvent on λ_{max} (impact on the n → π* transition): spectra of acetone in water, hexane and ethanol. (4)
10. IR spectroscopy. I part: recording the specta of isolated compounds (benzoic acid, sorbitol, thymol, aniline, 1-pentanol, acetone). (5)
11. IR spectroscopy, II part: recording spectra of selected solids and liquids. (5)
12. Analysis of obtained IR spectry and comparison by databases available on Internet (SDBS, NIST,...). Finding and analysing other available spectra in selected databases (MS, NMR,...). (5)
13. NMR spectroscopy. Analysis of NMR spectra (^{1}H i ^{13}C NMR) by using SPINWORKS software. (5)</td></tr>
<tr><td>Format of instruction</td><td colspan="3">X lectures
□ seminars and workshops
X exercises
□ on linein entirety
X partial e-learning
□ field work</td><td colspan="3">X independent assignments
X multimedia
X laboratory
□ work with mentor
X seminars</td></tr>
<tr><td>Student responsibilities</td><td colspan="6"></td></tr>
<tr><td rowspan="3">Screening student work(name the proportion of ECTS credits for each activity so that the total number of</td><td>Class attendance</td><td>1,5</td><td>Research</td><td>0</td><td>Practical training</td><td></td></tr>
<tr><td>Experimental work</td><td>1,5</td><td>Report</td><td>0</td><td>(Other)</td><td></td></tr>
<tr><td>Essay</td><td>0</td><td>Seminar essay</td><td>0</td><td>(Other)</td><td></td></tr>
</table>

ECTS credits is equal to the ECTS value of the course)	Tests	1,0	Oral exam	1,0	(Other)	
	Written exam	5,0	Project	0	(Other)	
Grading and evaluating student work in class and at the final exam	Course is divided into three sections that students take over 2 partial written and 1 oral exam or by final exam at the end of the semester. The student pass the exam if he/she achieves at least 60%. The final grade is based on the evaluation of partial exams and laboratory exercises. Scoring: <60% insufficient; 60-70% sufficient (2); 70-80% good (3); 80-90% very good (4); 90-100% excellent (5)					

	Title	**Number of copies in the library**	**Availability via other media**
Required literature (available in the library and via other media)	J. Mohan, *Organic Analytical Chemistry*, *Theory and Practice*, Alpha Science International Ltd., Pangbourne England, 2003.	1	ne
	D. L. Pavia, G. M. Lampman, G. S. Kriz, *Introduction to Spectroscopy, a guide for students of organic chemistry*, Harcourt College Publishers, USA, 2001.	1	ne
	E. Pretsch, J. Seibel, J. T. Clerc, *Tablice za određivanje strukture organskih spojeva spektroskopskim metodama*, SKTH/Kemija u industriji, 1982.	10	ne

Optional literature (at the time of submission of study programme proposal)	• E. Pretsch, P. Buehlmann, C. Affolter: "Structure Determination of Organic Compounds, Tables of Spectral data", Third Edition, Springer-Verlag Berlin Heidelberg, 2000. • H. Günzler, H.-U. Gremlich, *Uvod u infracrvenu spektroskopiju*, Školska knjiga Zagreb, 2006; • E. Breitmaier, *Structure Elucidation by NMR in Organic Chemistry*, Practical Guide, John Wiley & Sons, 2002; • I. Jerković, A. Radonić, *Praktikum iz organske kemije*, Udžbenici Sveučilišta u Splitu, Split, 2009.
Quality assurance methods that ensure the acquisition of exit competences	Quality assurance will be performed at three levels: (1) University Level; (2) Faculty Level by Quality Control Committee; (3) Lecturer's Level.
Other (as the proposer wishes to add)	

Quality Assurance and Accreditation in Laboratory Practice

NAME OF THE COURSE	Quality Assurance and Accreditation in Laboratory Practice					
Code	KTH215	Year of study	2nd			
Course teacher	PhD, Josipa Giljanović, associat prof.	Credits (ECTS)	6,5			
Associate teachers		Type of instruction (number of hours)	L	S	E	F
			30	15	28	2
Status of the course	Mandatory	Percentage of application of e-learning	30%			
COURSE DESCRIPTION						
Course objectives	Acquisition of basic knowledge about basic concepts and principles of quality management, requirements and criteria of testing laboratories according to the requirements of EN ISO / IEC 17025 standard.					
Course enrolment requirements and entry competences required for the course	Completed appropriate undergraduate study					
Learning outcomes expected at the level of the course (4 to 10 learning outcomes)	1. Understanding the quality menagement system in the laboratory including accreditation process laws and standards for accreditation 2. Apply laboratory tests, methods, the process of mesurements, uncertainty, quality control and documentation of the laboratory 3. Understand evaluation off laboratories tests, accreditation of laboratories, the system of authorization and accreditation in Europe and Croatia. 4. Apply knowledge in practice and link the theoretical knolidge with real problems in the laboratorywork.					
Course content broken down in detail by weekly class schedule (syllabus)	1st week: Analytical system. Sampling from the environment. Seminar: Solving problems. 2nd week: Preparation of the sample for analysis. Seminar: Solving problems. 3rd week: Method of isolation of the analyte from the nuts: solid phase extraction, microwave ultrasonic extraction. Seminar: Solving problems. 4th week: Spectroscopic methods. Molecular Spectroscopy. Seminar: Solving problems. 5th week: Atomic absorption spectroscopy, mass spectroscopy. Seminar: Solving problems. 6th week: Chromatographic methods: gas, ion, thin layer chromatography. Seminar: Solving problems. 7th Week : 1st. partial exam, solving the test 8th week: The standard methods and reference materials, validation. Seminar: Solving problems 9th week: sample for analysis, records, process evaluation and report, Seminar: Solving problems 10th week: subcontracting, external services and procurement; appeal. Seminar: Solving problems 11th week: GLP-principles, and procedures. Seminar: Solving problems 12th week: A system of authorization and accreditation in Europe and Croatia, principles and rules. Seminar: Solving problems 13th week:. The requirements of EN ISO / IEC 17025 (current edition). Seminar:					

<table>
<tr><td></td><td colspan="6">Solving problems
14th week: The requirements of EN ISO / IEC 17025 (current edition). Seminar: Solving problems
15th week : 2nd partial exam , solving the test
<u>List of Exercises</u>

documentation of good laboratory practice
individual documentation for ISO / IEC 17025: 2005
Development of manual quality
internal audits
visit to the Veterinary Institute Split</td></tr>
<tr><td>Format of instruction</td><td colspan="3">☒ lectures
☒ seminars and workshops
☒ exercises
☐on linein entirety
☐partial e-learning
☐field work</td><td colspan="3">☐independent assignments
☒ multimedia
☒ laboratory
☐work with mentor
☐ (other)</td></tr>
<tr><td>Studentresponsibilities</td><td colspan="6">Lectures attendance - at least 80% and completing exercises</td></tr>
<tr><td rowspan="6">Screening student work(name the proportion of ECTS credits for eachactivity so that the total number of ECTS credits is equal to the ECTS value of the course)</td><td>Class attendance</td><td>0.5</td><td>Research</td><td></td><td>Practical training</td><td></td></tr>
<tr><td>Experimental work</td><td></td><td>Report</td><td></td><td>Laboratory Exercises</td><td>1.0</td></tr>
<tr><td>Essay</td><td></td><td>Seminar essay</td><td>1.5</td><td>(Other)</td><td></td></tr>
<tr><td>Tests</td><td></td><td>Oral exam</td><td>1.0</td><td>(Other)</td><td></td></tr>
<tr><td>Written exam</td><td>1.0</td><td>Project</td><td>1.0</td><td>(Other)</td><td></td></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Grading and evaluating student work in class and at the final exam</td><td colspan="6">The entire test can be applied over two partial tests during the semester. Passing threshold is 60%. Each test in assessing participates with 50%. Lectures presence of 80 to 100% is 10% marks. The examination periods there is a written and oral exam. Passing threshold is 60%. Passing one partial test of any part (previous activity) is valid throughout current academic year. Written exam has a share of 50% and oral examination also 50%. Students who have not passed the partial tests will have oral examination in the regular examination period. Passing threshold is 60% and the examination form to participate in the evaluation by 50%.

Rating: 60% -69% - satisfactory, 70% -79% - good, 80% -89% very good, 90% -100% - excellent.</td></tr>
<tr><td>Required literature (available in the library and 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></td><td colspan="3">1. HRN EN ISO/IEC 17025:2005-Opći zahtjevi za osposobljenost ispitnih i umjernih laboratorija; , zakoni, propisi;
2. Guide to Quality in Analytical Chemistry, CITAC/EURACHEMGUIDE Edition (2002), 3. M.Kaštelan-Macan, Kemijska analiza u sustavu kvalitete, Školska knjiga, Zagreb (2003),</td><td>3</td><td colspan="2">Web page of the Department

http://www.eurachem.ul.pt/guides/valid.pdf),http://www.akredit</td></tr>
</table>

			acija.hr/; http://www.svijet-kvalitete.com/index.php/umjeravanje/504-postupak-akreditacije-laboratorija; http://www.european-accreditation.org/; Guide to Quality in Analytical Chemistry An Aid to Accreditation (http://pdf-world.net/pdf/31643/Guide-to-Quality-in-Analytical-Chemistry-pdf.php)
Optional literature (at the time of submission of study programme proposal)			
Quality assurance methods that ensure the acquisition of exit competences	• registration of student's presence in class • annual analysis of students success in this course • student's survey in order to evaluate the professor • professor's self-evaluation		
Other (as the proposer wishes to add)			

Chemistry of Materials

NAME OF THE COURSE	Chemistry of Materials					
Code	KTI102	Year of study	1st			
Course teacher	PhD, Marija Bralić, associate prof.	Credits (ECTS)	6.5			
Associate teachers	PhD, Maša Buljac, assistant prof. MSc, Goran Olujić, assistent	Type of instruction (number of hours)	L	S	E	F
			30	15	30	
Status of the course	Obligatory	Percentage of application of e-learning				
COURSE DESCRIPTION						
Course objectives	The basic objective of the course is to acquire knowledge about the chemical and physical properties of materials.					
Course enrolment requirements and entry competences required for the course						
Learning outcomes expected at the level of the course (4 to 10 learning outcomes)	After course students will be able to : 6. chemical characteristics of the material. 7. physical characteristics of the material: electrical, thermal, optical, magnetic and mechanical properties 8. materials: conductors, semiconductors, metals, ceramics, polymers, composites 9. sampling of different materials 10. preparation of a representative sample for analysis					
Course content broken down in detail by weekly class schedule (syllabus)	**Lecture 1:** Introduction. The chemical characteristics of the material **Lecture 2:** Chemical bond, the crystal lattice. **Lecture 3:** Physical characteristics of the material: electrical, thermal, optical, magnetic and mechanical properties **Seminar 1 (2 hours):** Data analysis and presentation of results. Assignments: Tests of acceptance and rejection results **Lecture 4:** Physical characteristics of the material: electrical, thermal, optical, magnetic and mechanical properties **Seminar 2 (2 hours):** The standard deviation of error. Calculate the mass of the sample **Lab course 1 (2 hours):** Familiarization with laboratories, institutes and exercises that will take place. **Lecture 5:** Groups of materials: conductors, semiconductors, metals, ceramics, polymers **Seminar 3 (2 hours):** Calculation of the composition of various solid materials. Shares, tasks with different problems **Lab course 2 (5 hours):** Standardization PO_4. Determination of PO_4 from seawater in HDPE and PP bottles and glass tubes **Lecture 6:** Testing and analysis of real samples **Lecture 7:** first partial colloquium **Lab course 3 (5 hours):** Standardization of NO_2. Determination of NO_2 from seawater in HDPE and PP bottles and glass tubes **Lecture 8:** Sampling of gases					

<table>
<tr><td></td><td colspan="6">Seminar 4 (2 hours): Assignments from the method of discharge. Assignments: interference-extraction
Lab course 4 (6 hours): Standardization SiO_4. Determination SiO_4 from seawater in HDPE and PP bottles and glass tubes
Lecture 9:. Sampling of liquid
Seminar 5 (2 hours): Separation and error calculation. Calculations of components of the various components in an aqueous system,
Lecture 10: Sampling of solid
Seminar 6 (2 hours): Eligible and illicit quantity calculations for solids
Lab course 5 (5 hours): Standardization of NO_3. Determination of NO_3 from seawater in HDPE and PP bottles and glass tubes
Lecture 11: Preparation of a representative sample for analysis
Seminar 7 (2 hours): Assignments: gases, calculations composition
Lecture 12: Preparation of a representative sample for analysis
Lecture 13: Decomposition of samples
Lecture 14: Seminar
Lab course 6 (4 hours): Sandardizacija NH_4. Determination of NH_4 from seawater in HDPE and PP bottles and glass tubes
Lecture 15: 2th partial colloquium
Seminar 8 (1 hour): Assignments: gases, calculations composition
Lab course 7 (3 hours): Computer and graphical analysis of the results</td></tr>
<tr><td>Format of instruction</td><td colspan="3">×lectures
×seminars and workshops
×exercises
☐on linein entirety
☐partial e-learning
☐field work</td><td colspan="3">☐independent assignments
☐multimedia
×laboratory
☐work with mentor
☐ (other)</td></tr>
<tr><td>Studentresponsibilities</td><td colspan="6"></td></tr>
<tr><td rowspan="6">Screening student work(name the proportion of ECTS credits for eachactivity so that the total number of ECTS credits is equal to the ECTS value of the course)</td><td>Class attendance</td><td>1.0</td><td>Research</td><td></td><td>Practical training</td><td></td></tr>
<tr><td>Experimental work</td><td>1.0</td><td>Report</td><td></td><td>(Other)</td><td></td></tr>
<tr><td>Essay</td><td></td><td>Seminar essay</td><td>0.5</td><td>(Other)</td><td></td></tr>
<tr><td>Tests</td><td>1.0</td><td>Oral exam</td><td>2.0</td><td>(Other)</td><td></td></tr>
<tr><td>Written exam</td><td>1.0</td><td>Project</td><td></td><td>(Other)</td><td></td></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Grading and evaluating student work in class and at the final exam</td><td colspan="6">During the semester, the two partial test to check if the knowledge of students from courses included material. During the semester students will be selected from the lecture topic to make a seminar that will affect the final grade. After completion of the semester, students take a written exam courses included material from the seminar. If the student meets at one of the partial tests during the semester, material from passing the test does not need to take the written exam. After passing the written part of the exam, the oral exam. Prior to joining the laboratory exercises, students' knowledge of material from the respective exercise will be verified by tests. All exercises must be passed all preliminary exams and completed. The student has the right to exercise fail one exercise, but you will catch up at the end of the semester. For all aspects of teaching evaluation will be conducted according to the following criteria: <55% inadequate; 55% -65% is sufficient; 66% -75% good; 76% -85% very good;> 86% excellent. The final grade will be the arithmetic average of ratings from exercises, written assessment and oral examination.</td></tr>
</table>

	Title	Number of copies in the library	Availability via other media
Required literature (available in the library and via other media)	Yitzhak Mastai**,** Materials Science: Advanced Topics, InTech 2013 W.D.Callister Jr.and D.G. Rethwisch, Fundamentals of materials science and engineering; An integrated approach, RP Library, 2010.		1 1
	Brian S. Mitchell, an introduction to materials engineering and science for chemical and materials engineers, A JOHN WILEY & SONS, INC., New Jersey, 2004..		1
Optional literature (at the time of submission of study programme proposal)	J.I. Gersten, F.W. Smith, The Physics and Chemistry of Materials, New York, 2001;		
Quality assurance methods that ensure the acquisition of exit competences	Methods Quality assurance will be performed at three levels: (1) University; (2) Faculty Level by Quality Control Committee of teaching; (3) Level.		
Other (as the proposer wishes to add)			

Analytical Environmental Chemistry

NAME OF THE COURSE	Analytical Environmental Chemistry					
Code	KTI103	Year of study	1st			
Course teacher	PhD, Marija Bralić, associate prof.	Credits (ECTS)	7.5			
Associate teachers	PhD, Maša Buljac, assistant prof.	Type of instruction (number of hours)	L	S	E	F
			30	15	45	
Status of the course	Obligatory	Percentage of application of e-learning				

COURSE DESCRIPTION

Course objectives	The basic objective of the course is the application of analytical methods and techniques in environmental analysis.
Course enrolment requirements and entry competences required for the course	Gateways must have a good basic knowledge of analytical chemistry, physical chemistry, organic chemistry, but are not necessary to master the material..
Learning outcomes expected at the level of the course (4 to 10 learning outcomes)	After course students will be able to : 8. to know and explain the interactions that occur between different phases in the environment (water-to-air, ground-to-air, water-soil) 9. independently sampling plan (accidentally uozkovanje, stratified sampling, systematic sampling, intuitive sampling) 10. to sample (air, water, soil, sediment and biological samples). 11. prepare samples for analysis, use of modern methods of sample preparation 12. Use a variety of techniques for environmental analysis (classical methods, instrumental methods, the technique, other techniques. 13. exert biological control (environmental indicators, biomarkers) 14. process the results of analysis
Course content broken down in detail by weekly class schedule (syllabus)	**Lecture 1:** Introduction - environmental science and environmental analytical chemistry **Lecture 2:** Chemical Principles in the environment. Sampling from the environment **Lecture 3:** analytical separation, sample preparation for analysis **Seminar 1 (2 hours):** interpretation and data processing. Standard deviations, errors **Lecture 4:** The application of analytical methods and techniques in environmental analysis. Elektoroanalytical methods (potentiometry) **Seminar 2 (2 hours):** Quantitatively the composition of solutions - expressing concentration **Lab course 1 (5 hours):** Potentiometric determination of fluoride and chloride. Determination of iron in drinking water. **Lecture 5:** Voltammetry, coulometry **Seminar 3 (2 hours):** Calculating the pH of water of different composition and nature (sea, river, rain) **Lab course 2 (5 hours):** Determination of the pH of various types of water (river, rain) **Lecture 6:** Conductometry, spectrometric techniques **Lecture 7:** Absorption Spectrometry, induced absorption spectrometry, emission

<table>
<tr><td></td><td colspan="6">spectrometry
Lab course 3 (5 hours): Determining the concentration of transition metal in the pure aqueous solutions of UV-VIS spectrophotometry
Lecture 8: Instrumental separation techniques, gas chromatography
Seminar 4 (2 hours): Calculations data spectrometric measurements
Lab course 4 (5 hours): Determination of nitrate, nitrite and ammonium in wastewater by spectrophotometry
Lecture 9:. Liquid chromatography, the state and development of chromatographic techniques
Seminar 5 (2 hours): Calculations of trace metals in the environment
Lecture 10: Other techniques (thermal techniques, radiochemical techniques)
Seminar 6 (2 hours): The calculation of the concentration of particulate matter in the environment and display the result
Lab course 5 (5 hours): Determination of phosphorus in the solid plant
Lecture 11: Trace elements in the environment: natural level and chemical form of pollution
Seminar 7 (2 hours): Statistical analysis of the results of the analysis of environmental samples (air, water, soil)
Lecture 12: Determination of trace organic compounds
Lecture 13: Biological indicators and methods
Lecture 14: The radiation and radioactivity in the environment. contamination of soil
Lab course 6 (5 hours): Voltammetric determination of ascorbic acid in multivitamins
Lab course 7 (5 hours): Determination of organic matter in soil
Lecture 15: Evaluation and interpretation of analytical data from the environment. specific applications
Lab course 8 (5 hours): Determination of grain size characteristics of sediment
Seminar 8 (1 hour): Correlations (Spearman, Pearson,)
Lab course 9 (5 hours): Determination of the metal in particulate matter</td></tr>
<tr><td>Format of instruction</td><td colspan="3">×lectures
×seminars and workshops
×exercises
☐on linein entirety
☐partial e-learning
☐field work</td><td colspan="3">☐independent assignments
☐multimedia
×laboratory
☐work with mentor
☐ (other)</td></tr>
<tr><td>Studentresponsibilities</td><td colspan="6"></td></tr>
<tr><td rowspan="6">Screening student work(name the proportion of ECTS credits for eachactivity so that the total number of ECTS credits is equal to the ECTS value of the course)</td><td>Class attendance</td><td>1.0</td><td>Research</td><td></td><td>Practical training</td><td></td></tr>
<tr><td>Experimental work</td><td>2.0</td><td>Report</td><td></td><td>(Other)</td><td></td></tr>
<tr><td>Essay</td><td></td><td>Seminar essay</td><td>1.0</td><td>(Other)</td><td></td></tr>
<tr><td>Tests</td><td>0.5</td><td>Oral exam</td><td>2.0</td><td>(Other)</td><td></td></tr>
<tr><td>Written exam</td><td>1.0</td><td>Project</td><td></td><td>(Other)</td><td></td></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Grading and evaluating student work in class and at the final exam</td><td colspan="6">During the semester, the two partial test to check if the knowledge of students from courses included material. During the semester students will be selected from the lecture topic to make a seminar that will affect the final grade. After completion of the semester, students take a written exam courses included material from the seminar. If the student meets at one of the partial tests during the semester, material from passing the test does not need to take the written exam. After passing</td></tr>
</table>

<table>
<tr><td></td><td colspan="3">the written part of the exam, the oral exam. Prior to joining the laboratory exercises, students' knowledge of material from the respective exercise will be verified by tests. All exercises must be passed all preliminary exams and completed. The student has the right to exercise fail one exercise, but you will catch up at the end of the semester. For all aspects of teaching evaluation will be conducted according to the following criteria: <55% inadequate; 55% -65% is sufficient; 66% -75% good; 76% -85% very good;> 86% excellent. The final grade will be the arithmetic average of ratings from exercises, written assessment and oral examination.</td></tr>
<tr><td rowspan="4">Required literature (available in the library and via other media)</td><td>Title</td><td>Number of copies in the library</td><td>Availability via other media</td></tr>
<tr><td>D. Ašperger et al, Analitika okoliša, HINUS&FKIT, Zagreb 2013.

F.W. Fifield, P.J. Haines, Environmental Analytical Chemistry, Blackie academic& professional, London, 1996</td><td></td><td>1

1</td></tr>
<tr><td>E. P. Popek Sampling and analysis of environmental chemical pollutants, AP, 2003.</td><td></td><td>1</td></tr>
<tr><td>Vježbe iz Analitičke kemije okoliša (interna skripta u pripremi), Kemijsko-tehnološki fakultet, Split, 201X</td><td></td><td>1</td></tr>
<tr><td>Optional literature (at the time of submission of study programme proposal)</td><td colspan="3">C.E. Kupchella, M. C. Hyland, Enviromental science, Massachusetts, 1989</td></tr>
<tr><td>Quality assurance methods that ensure the acquisition of exit competences</td><td colspan="3">Methods Quality assurance will be performed at three levels: (1) University; (2) Faculty Level by Quality Control Committee of teaching; (3) Level.</td></tr>
<tr><td>Other (as the proposer wishes to add)</td><td colspan="3"></td></tr>
</table>

Surface Chemistry

NAME OF THE COURSE	Surface Chemistry					
Code	KTI104	Year of study	1st			
Course teacher	PhD, Zoran Grubač, prof.	Credits (ECTS)	6.0			
Associate teachers		Type of instruction (number of hours)	L	S	E	F
			30	15	30	
Status of the course	Election	Percentage of application of e-learning				
COURSE DESCRIPTION						
Course objectives	Deepen the knowledge of a structure of metallic surfaces, adsorption molecules on surfaces and surface analytical techniques.					
Course enrolment requirements and entry competences required for the course						
Learning outcomes expected at the level of the course (4 to 10 learning outcomes)	After the course students will be able to: • Describe the structure of metallic surfaces • Define crystalline systems • Determine the symmetry of unit cell • Describe the crystal plane using Miller indices and derive the plane spacing • Conduct complex experiments in the laboratory and interpret collected data and results of measurement • Change the properties of the surface by conducting experiments					
Course content broken down in detail by weekly class schedule (syllabus)	Structure of Metallic Surfaces, Adsorption of Molecules on Surfaces, The Langmuir Isotherm, Surface Analytical Techniques, Overlayer Structures & Surface Diffraction; Surface Imaging & Depth Profiling <u>Lectures:</u> 13. The structure of metal surfaces. Unit cell. Crystal systems 14. Symmetry. Symmetry of the unit cell. 15. Lattice planes and Miler indices. The distance between the planes. X-ray diffraction from crystals. 16. Inorganic crystal structures. Hexagonal close packing. Cubic dense packing. 17. ccp, fcc, bcc; Positional coordinates, Bond lengths, sizes of interstitials. 18. The structure of the surface of fcc metals. The structure of the surface hcp metals. 19. Energy of solid surfaces. Relaxation and reconstruction of the surfaces. 20. Molecular adsorption. The curve of potential energy - energy of adsorption. 21. Nucleation, formation and growth of new phase 22. Langmuir adsorption isotherm, ultrahigh vacuum. 23. Methods of preparation and characterization of surfaces I. 24. Methods of preparation and characterization of surfaces II. <u>Seminars:</u> 1. Unit cell. Calculations with unit cells 2. Miler indices. Drawing surfaces if Miler indices are known. Determination the Miler indices for a known plane. 3. Positional coordinates. Calculate the length of the bond. 4. The structure of the surface of hcp metals 5. Molecular adsorption. Adsorption kinetics. 6. 2D and 3D nucleation. Determination of the number of nuclei.					

<table>
<tr><td></td><td colspan="6">Laboratory exercises:

6. Development of electrodes for electrochemical measurements
7. Determination of the real surface area of the electrode - assessment criteria or reversibility of reaction of Fe2 + / Fe3 + at different electrodes.
8. Determination of the real surface area of the electrode - estimation by using electrochemical impedance spectroscopy
9. Potentiostatic formation of oxide / hydroxide film on the electrodes of the magnesium in borate electrolyte with mathematical analysis.
10. Analysis of potentiostatic transients for 2D and 3D nucleation.</td></tr>
<tr><td>Format of instruction</td><td colspan="3">x lectures
x seminars and workshops
x exercises
☐ on line in entirety
☐ partial e-learning
☐0 field work</td><td colspan="3">☐ independent assignments
☐ multimedia
x laboratory
☐ work with mentor
☐ (other)</td></tr>
<tr><td>Student responsibilities</td><td colspan="6">The 80% presence at lectures and seminars, and completed all laboratory exercises.</td></tr>
<tr><td rowspan="6">Screening student work (name the proportion of ECTS credits for each activity so that the total number of ECTS credits is equal to the ECTS value of the course)</td><td>Class attendance</td><td>2.0</td><td>Research</td><td></td><td>Practical training</td><td></td></tr>
<tr><td>Experimental work</td><td>2.0</td><td>Report</td><td></td><td>(Other)</td><td></td></tr>
<tr><td>Essay</td><td></td><td>Seminar essay</td><td></td><td>(Other)</td><td></td></tr>
<tr><td>Tests</td><td></td><td>Oral exam</td><td>1.0</td><td>(Other)</td><td></td></tr>
<tr><td>Written exam</td><td>1.0</td><td>Project</td><td></td><td>(Other)</td><td></td></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Grading and evaluating student work in class and at the final exam</td><td colspan="6">Prior to joining the laboratory exercises, students' knowledge of the material concerned exercises will be verified by tests. All exercises must be completed. Students who obtain a signature from the course Surface Chemistry can take the exam. The exam consists of a written and oral examination. The student approached the oral exam must first pass a written examination. The written part of the exam lasts two hours. The written part of the exam is evaluated as follows :
Exactly solved more than 55 % - sufficient
Exactly solved more than 70 % - good
Exactly solved more than 80 % - very good
Exactly solved more than 90 % - excellent
After the written exam on the notice board of the Department will be advertised results of the exam and time when students which did not pass the written exam can view tasks and schedule for oral examinations for students which have acquired this right.
A complete examination or part thereof may be installed through two partial tests during the semester. The tests cover material presented in lectures, seminars and exercises. Written tests are evaluated in the following manner:
Exactly solved more than 55 % - released a written exam
Exactly solved by 60 % - freed written and oral - sufficient
Exactly solved by 70 % - freed written and oral - good
Exactly solved by 80 % - freed written and oral - very good
Exactly solved by 90 % - freed written and oral - excellent
It is necessary to pass all tests in order to pass the exam. Students who did not meet any of the tests must take written and oral exam of that part.</td></tr>
<tr><td>Required literature (available in the</td><td colspan="4">Title</td><td>Number of copies in</td><td>Availability via other media</td></tr>
</table>

library and via other media)		**the library**	
	G.A. Somorjai, Introduction to Surface Chemistry and Catalysis, Wiley-Interscience, New York, 1994..		
	K. Christmann, Introduction to Surface Physical Chemistry, Springer-Verlag, New York, 1991.		
	Zoran Grubač: „Predavanja iz Kemije površina“		web http://www.ktf-split.hr
Optional literature (at the time of submission of study programme proposal)	P.W. Atkins and J. de Paula, Physical Chemistry, 7th Ed., Freeman, NewYork, 2002.; A. W. Adamson and A. P. Gast, Physical Chemistry of Surfaces, 6th Ed., Wiley-Interscience, New York, 1997.		
Quality assurance methods that ensure the acquisition of exit competences	- Information from interviews, observations, and consultation with students during lectures - Student survey		
Other (as the proposer wishes to add)			

Chemistry of Sea

NAME OF THE COURSE	Chemistry of Sea					
Code	KTI201	Year of study	2nd			
Course teacher	PhD, Marija Bralić, associate prof.	Credits (ECTS)	6.5			
Associate teachers	PhD, Maša Buljac, assistant prof.	Type of instruction (number of hours)	L	S	E	F
			30	15	30	
Status of the course	Obligatory	Percentage of application of e-learning				
COURSE DESCRIPTION						
Course objectives	Gaining knowledge of the sea; chemical and physical composition and properties of the sea.					
Course enrolment requirements and entry competences required for the course						
Learning outcomes expected at the level of the course (4 to 10 learning outcomes)	After course students will be able to : 1. fundamental properties of seawater 2. basic physical properties of the sea 3. chemical composition of seawater 4. marine pollution, sources and types of pollution 5. interactive impact of pollutants on the marine environment 6. chemicals in the sea and the manner of their removal					
Course content broken down in detail by weekly class schedule (syllabus)	**Lecture 1:** Introduction to marine chemistry. The fundamental properties of sea water, the origin of water and salt. **Lecture 2:** The composition of the oceans and marine sediment **Seminar 1 (2 hours):** The numerical assignments from the properties and composition of seawater. **Lecture 3:** The basic physical properties of the sea. **Lecture 4:** Chemical composition of seawater. Salinity and density **Seminar 2 (2 hours):** Salinity and density **Lecture 5:** The chemical species in the sea (major constituents and micro-constituents). **Lecture 6:** Gases in the sea . **Seminar 3 (2 hours):** Analysis of the gases in the sea **Lecture 7:** Dissolved organic matter in the sea. **Lecture 8:** Marine pollution, sources and types **Seminar 4 (2 hours):** The numerical assignments from dissolved substances in the sea **Lecture 9:**. Metals in the sea **Lecture 10:** Degradable and durable organic compounds. **Seminar 5 (2 hours):** Numerical problems in organic matter in the sea **Lecture 11:** Urban waste. Petroleum and petroleum products. Water from the cooling system. Radioactive waste. **Lecture 12:** Pesticides. The impact of pollutants on the marine environment **Seminar 6 (2 hours):** Pollutants in the sea **Lecture 13:** Plant protection (cleaning) must **Lecture 14:** Preventing contamination / pollution from vessels.					

	Lecture 15: Legal regulations on marine environmental protection. **Seminar 7 (3 hours):** Legal regulations on marine environmental protection **Lab course:** Determination of salinity and chlorinity of seawater. Determination of the pH and alkalinity.Determination of oxygen. Determination of nutrients. Determination of metals in marine sediments. Determination of organic matter in marine sediments. Determination of carbonate in marine sediments.

Format of instruction	×lectures ×seminars and workshops ×exercises ☐*on line*in entirety ☐partial e-learning ☐field work	☐independent assignments ☐multimedia ×laboratory ☐work with mentor ☐ (other)
Studentresponsibilities		

Screening student work*(name the proportion of ECTS credits for eachactivity so that the total number of ECTS credits is equal to the ECTS value of the course)*						
	Class attendance	0.5	Research		Practical training	
	Experimental work	1.0	Report		(Other)	0.5
	Essay		Seminar essay	0.5	(Other)	
	Tests	1.0	Oral exam	2.0	(Other)	
	Written exam	1.0	Project		(Other)	

Grading and evaluating student work in class and at the final exam	During the semester, the two partial test to check if the knowledge of students from courses included material. During the semester students will be selected from the lecture topic to make a seminar that will affect the final grade. After completion of the semester, students take a written exam courses included material from the seminar. If the student meets at one of the partial tests during the semester, material from passing the test does not need to take the written exam. After passing the written part of the exam, the oral exam. Prior to joining the laboratory exercises, students' knowledge of material from the respective exercise will be verified by tests. All exercises must be passed all preliminary exams and completed. The student has the right to exercise fail one exercise, but you will catch up at the end of the semester. For all aspects of teaching evaluation will be conducted according to the following criteria: <55% inadequate; 55% -65% is sufficient; 66% -75% good; 76% -85% very good;> 86% excellent. The final grade will be the arithmetic average of ratings from exercises, written assessment and oral examination.

Required literature (available in the library and via other media)	**Title**	**Number of copies in the library**	**Availability via other media**
	M. Buljan, M. Zore-Armanda: Osnovi oceanografije i pomorske meteorologije, Institut za oceanografiju i ribarstvo-Split, Split, 1971.		1 1
	B.A. Duxbury, A.C. Duxbury, Fundamental of oceanography, WCB, Melbourn, Oxford, 1993.		
	Z. Bičanić: Zaštita mora i morskog okoliša; Z. Bičanić-vlastita naklada, Split, 2004		1
	R.B. Clark: Marine Polution, Clarenddon Press, Oxford, 1986.		1

Optional literature (at the time of submission of study programme proposal)	E Prohić: Geokemija, Targa, Zagreb, 1998. Stumm, J.J. Morgan, Aquatic Chemistry: Chemical Equilibria and Rates in Natural Waters, John Wiley&Sons, New York, 1995.
Quality assurance methods that ensure the acquisition of exit competences	Methods Quality assurance will be performed at three levels: (1) University; (2) Faculty Level by Quality Control Committee of teaching; (3) Level.
Other (as the proposer wishes to add)	

Atmospheric Chemistry

NAME OF THE COURSE	Atmospheric Chemistry					
Code	KTI202	Year of study	2nd			
Course teacher	PhD, Marija Bralić, associate prof.	Credits (ECTS)	7.5			
Associate teachers	PhD, Maša Buljac, assistant prof.	Type of instruction (number of hours)	L	S	E	F
			45	15	15	
Status of the course	Obligatory	Percentage of application of e-learning				
COURSE DESCRIPTION						
Course objectives	To provide students with basic knowledge of the atmosphere; structure, chemical cycles, and pollution, as well as the means for preventing the emission of harmful substances into the environment.					
Course enrolment requirements and entry competences required for the course						
Learning outcomes expected at the level of the course (4 to 10 learning outcomes)	After course students will be able to : 1. definition of basic concepts and history of the chemistry of the atmosphere 2. geochemical relationship of the Earth and the Sun. 3. classification of pollutants and their origin in the atmosphere 4. evaluation and screening of air quality 5. thermodynamics and kinetics of formation of oxides in the atmosphere 6. the role of various pollutants in photochemical processes in the atmosphere 7. techniques and sampling procedures of harmful substances in the atmosphere					
Course content broken down in detail by weekly class schedule (syllabus)	**Lecture 1:** Basic characteristics of the atmosphere. The structure of the atmosphere. The composition of the atmosphere **Lecture 2:** The atmosphere as the photochemical system. Incoming radiation-solar spectrum. The absorption coefficient of atmospheric gases **Seminar 1 (2 hours):** Numerical methods for solving problems related to radiation and the absorption coefficient **Lecture 3:** Re-emission radiation-cooling the Earth's surface. temperature inversions **Lecture 4:** Contaminants atmospheres and their origin. Expression of the content of pollutants in the atmosphere. Building an information system based on the list of pollutants, meteorological data and emission measurements **Seminar 2 (2 hours):** Solving problems related to the expression of content pollution in the atmosphere **Lecture 5:** Rating and projections of air quality. Emission and immission standards **Lab course 1 (3 hours):** Determination of PM_{10} and $PM_{2.5}$ **Lecture 6:** The kinetics of formation of carbon (II) oxide and control its emissions **Lecture 7:** Thermodynamics and kinetics of formation of sulfur oxides. The basic methods of controlling sulfur oxides **Seminar 3 (2 hours):** Numerical methods for solving problems related to the					

<table>
<tr><td></td><td colspan="6">kinetics and thermodynamics of formation of CO_2, CO and SO_x
Lab course 2 (3 hours): Determination of the metal particulate matter
Lecture 8: Thermodynamics of the formation of NO and NO_2 (NO_x). Sources of NOx emissions
Lecture 9: The kinetics of formation of NO in the process of combustion. Methods for controlling NOx emissions from stationary sources
Lecture 10: Assessing the weight of compounds of carbon, sulfur and nitrogen in the atmosphere; emission sources, conversion, life time of each compound.
Seminar 4 (2 hours): Numerical methods for solving problems related to NOx
Lab course 3 (3 hours): Determination of CO, CO_2 and SO_2
Lecture 11: Analysis of the increase in the acidity of precipitation. Creating monoatomnog oxygen and ozone
Lecture 12: Chemical reduction of the stratospheric ozone protective layer. Photochemical reactions of atmospheric pollution
Seminar 5 (2 hours): Numerical methods for solving problems related to the occurrence of acidity in the atmosphere and photochemical reactions
Lab course 4 (3 hours): Determination of NO_x and NH_4^+
Lecture 13: The role of various primary pollutants in photochemical processes in the atmosphere
Lecture 14: The lifetime of harmful substances in the lower atmosphere-deposition mechanisms
Seminar 6 (2 hours): Numerical methods for solving problems related to the concentration of NO_x, SO_x, and NH_4^+
Lab course 5 (3 hours): Determination of the concentration of ozone
Lecture 15: Techniques and procedures for sampling of pollutants in the atmosphere
Seminar 7 (3 hours): Statistical analysis of data provided by the monitoring</td></tr>
<tr><td>Format of instruction</td><td colspan="3">×lectures
×seminars and workshops
×exercises
☐on linein entirety
☐partial e-learning
☐field work</td><td colspan="3">☐independent assignments
☐multimedia
×laboratory
☐work with mentor
☐ (other)</td></tr>
<tr><td>Studentresponsibilities</td><td colspan="6"></td></tr>
<tr><td rowspan="6">Screening student work(name the proportion of ECTS credits for eachactivity so that the total number of ECTS credits is equal to the ECTS value of the course)</td><td>Class attendance</td><td>1.0</td><td>Research</td><td></td><td>Practical training</td><td></td></tr>
<tr><td>Experimental work</td><td>1.0</td><td>Report</td><td></td><td>(Other)</td><td>0.5</td></tr>
<tr><td>Essay</td><td></td><td>Seminar essay</td><td>1.0</td><td>(Other)</td><td></td></tr>
<tr><td>Tests</td><td>1.0</td><td>Oral exam</td><td>2.0</td><td>(Other)</td><td></td></tr>
<tr><td>Written exam</td><td>1.0</td><td>Project</td><td></td><td>(Other)</td><td></td></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Grading and evaluating student work in class and at the final exam</td><td colspan="6">During the semester, the two partial test to check if the knowledge of students from courses included material. During the semester students will be selected from the lecture topic to make a seminar that will affect the final grade. After completion of the semester, students take a written exam courses included material from the seminar. If the student meets at one of the partial tests during the semester, material from passing the test does not need to take the written exam. After passing the written part of the exam, the oral exam. Prior to joining the laboratory exercises, students' knowledge of material from the respective exercise will be verified by</td></tr>
</table>

<table>
<tr><td></td><td colspan="3">tests. All exercises must be passed all preliminary exams and completed. The student has the right to exercise fail one exercise, but you will catch up at the end of the semester. For all aspects of teaching evaluation will be conducted according to the following criteria: <55% inadequate; 55% -65% is sufficient; 66% -75% good; 76% -85% very good;> 86% excellent. The final grade will be the arithmetic average of ratings from exercises, written assessment and oral examination.</td></tr>
<tr><td rowspan="6">Required literature (available in the library and via other media)</td><td>Title</td><td>Number of copies in the library</td><td>Availability via other media</td></tr>
<tr><td>Mar Viana, Urban Air Quality in Europe, Springer-Verlag Berlin Heidelberg 2013</td><td></td><td>1

1</td></tr>
<tr><td>N. P. Cheremisinoff, Handbook of air pollution prevention and control, Elsevier Science (USA), 2002..</td><td></td><td>1</td></tr>
<tr><td>D.J. Jacob, Introduction to Atmospheric Chemistry, Princeton University
Press, New Jersey, 1999.</td><td></td><td>1</td></tr>
<tr><td>S.E. Manahan, Environmental Chemistry, Sixth Edition, Lewis Publishers, London, 1994.</td><td></td><td>1</td></tr>
<tr><td>C. Baird, Environmental
Chemistry, W. H. Freeman and Company, New York, 1999.</td><td></td><td>1</td></tr>
<tr><td>Optional literature (at the time of submission of study programme proposal)</td><td colspan="3">R.M. Harrison, Understanding Our Environment: An Introduction to Environmental Chemistry and Pollution, Second Edition, The Royal Society of Chemistry, Cambridge, 1992.

P. Brimblecombe, Air Composition and Chemistry, Cambridge University Press, Cambridge, 1986.</td></tr>
<tr><td>Quality assurance methods that ensure the acquisition of exit competences</td><td colspan="3">Methods Quality assurance will be performed at three levels: (1) University; (2) Faculty Level by Quality Control Committee of teaching; (3) Level.</td></tr>
<tr><td>Other (as the proposer wishes to add)</td><td colspan="3"></td></tr>
</table>

Soil Chemistry

NAME OF THE COURSE	Soil Chemistry					
Code	KTI 203	Year of study	2nd			
Course teacher	PhD, Marija Bralić, associate prof.	Credits (ECTS)	6.5			
Associate teachers	PhD, Maša Buljac, assistant prof.	Type of instruction (number of hours)	L	S	E	F
			30	15	30	
Status of the course	Obligatori	Percentage of application of e-learning				
COURSE DESCRIPTION						
Course objectives	To introduce students to the properties of mineral and organic matter of the soil and their role in chemical processes in the soil. Determine the concentration and composition of the soil solution, the importance and role of soil reaction, acidity, alkalinity and salinity for certain soil properties and processes in the soil. Analyze soil contamination by organic and inorganic compounds.					
Course enrolment requirements and entry competences required for the course						
Learning outcomes expected at the level of the course (4 to 10 learning outcomes)	After course students will be able to : □ Identify chemical composition pedosphere, the origin of the chemical constituents in the soil □ To compare the natural and anthropogenic processes caused by the transformation of mineral and organic matter in soil □ Establish similarities and differences in the chemical processes in different soils □ The sources of soil contamination as a result of human activity □ Make a plan of chemical analyzes for different needs □ To elaborate obtained knowledge of soil					
Course content broken down in detail by weekly class schedule (syllabus)	**Lecture 1:** Introduction. Definition of basic concepts in chemistry of soil **Lecture 2:** The fundamental substrates and processes of pedogenesis **Lecture 3:** Mineral soil structure (oxides and hydroxides of Al, Si, Fe, Mn, no silicate minerals, secondary clay minerals, ion dispersion) **Seminar 1 (2 hours):** Redox reactions of cations and anions at the solid-liquid **Lab course 1** (**4 hours**): Soil analysis (determining the acidity of the soil, the determination of total carbonate in the soil). **Lecture 4:** The organic structure of the soil (fresh remains on the ground and in the soil, transformation of soil organic matter, mineralization, humus- origin, composition and properties, divisions humus importance of humus for soil fertility). **Lecture 5:** The liquid phase of the soil. The properties of the soil solution. **Seminar 2 (2 hours):**. soil acidity, soil pH **Lab course 2 (4 hours):** Determination of buffering capacity of the soil. **Lecture 6:** The processes of precipitation and dissolution **Lecture 7**: I. Partial Test **Seminar 3 (2 hours):** Methods of measuring soil acidity **Lab course 3 (4 hours):** Determination of ammonium nitrogen in the soil with Nessler reagent. **Lecture 8:** Reactions of cations and anions at the interface soil-solution					

<table>
<tr><td></td><td colspan="6">Lecture 9: The acidity of the soil, methods of measuring soil acidity, soil acidity and origin correction of soil acidity.
Seminar 4 (2 hours): The redox potential of the soil and the practical application
Lab course 4 (4 hours): Determination of physiologically active lime (CaO%) by the method of Galeta.
Lecture 10: Alkalinity, salinity, soil buffers. Soil contamination from organic and inorganic compounds
Lecture 11:: The basic principles of electrochemistry.
Seminar 5 (2 hours): The chemical composition of the organic portion of soil.
Lab course 5 (4 hours): Determination of total nitrogen in plant material and soil by the method of Kjeldahl.
Lecture 12: The redox potential of the soil and practical application.
Lecture 13: The properties of colloids in the environment.
Seminar 6 (2 hours): The liquid phase of the soil
Lab course 6 (5 hours): Determination of exchangeable aluminum in the soil by the method of Sokolov presented.
Lecture 14: The problems of soil contamination.
Lecture 15: II. partial test
Seminar 7 (2 hours): oxido-reducing conditions in the soil
Lab course 7 (5 hours): Determination of humus at Kotzman</td></tr>
<tr><td>Format of instruction</td><td colspan="3">×lectures
×seminars and workshops
×exercises
☐on linein entirety
☐partial e-learning
☐field work</td><td colspan="3">☐ndependent assignments
☐multimedia
×laboratory
☐work with mentor
☐ (other)</td></tr>
<tr><td>Studentresponsibilities</td><td colspan="6"></td></tr>
<tr><td rowspan="5">Screening student work(name the proportion of ECTS credits for eachactivity so that the total number of ECTS credits is equal to the ECTS value of the course)</td><td>Class attendance</td><td>1.0</td><td>Research</td><td></td><td>Practical training</td><td>0.5</td></tr>
<tr><td>Experimental work</td><td>1.0</td><td>Report</td><td></td><td>(Other)</td><td></td></tr>
<tr><td>Essay</td><td></td><td>Seminar essay</td><td></td><td>(Other)</td><td></td></tr>
<tr><td>Tests</td><td>1.0</td><td>Oral exam</td><td>2.0</td><td>(Other)</td><td></td></tr>
<tr><td>Written exam</td><td>1.0</td><td>Project</td><td></td><td>(Other)</td><td></td></tr>
<tr><td>Grading and evaluating student work in class and at the final exam</td><td colspan="6">During semester two exams will be performed. Final examinations will be administered during formal examination periods. The following percentage equivalents apply to final grade: <55% Failure; 56%-66% (2); 67%-78% (3); 79%-90% (4);> 90% (5). After written exam, student will attend to oral exam. Lecturers do not give grades. Students earn grades.</td></tr>
<tr><td rowspan="2">Required literature (available in the library and via other media)</td><td colspan="3">Title</td><td colspan="2">Number of copies in the library</td><td>Availability via other media</td></tr>
<tr><td colspan="3">D.L. Sparks, Environmental Soil Chemistry, 2 nd edition Academic Press,
London, 2003.
M. Cresser, K. Killham, T. Edwards, Soil Chemistry and its applications, Cambridge University</td><td colspan="2"></td><td>One copy in the</td></tr>
</table>

	Press, Cambridge, 1993.; A. Škorić, Postanak, razvoj i sistematika tala, Sveučilište u Zagrebu, 1986 A. Škorić, Sastav i svojstva tla, Fakultet poljoprivrednih znanosti, Zagreb, 1991.		Department
	E. Prohić, Geokemija, Targa, Zagreb, 1998.		One copy in the Department
	Vježbe iz Kemije tla (interna skripta u pripremi), Kemijsko-tehnološki fakultet, Split, 201X		One copy in the Department
Optional literature (at the time of submission of study programme proposal)	T. G. Spiro, W. M. Stigliani, Chemistry of environment, Prentice Hall, New Jersey, 1996; A. Škorić, Priručnik za pedološka istraživanja, Fakultet poljoprivrednih znanosti, Zagreb, 1982.; C.S. Kupchella, M.C. Hyland, Environmental science, 2 nd edition, Allyn and Bacon, Massachusetts, 1989.		
Quality assurance methods that ensure the acquisition of exit competences	Monitoring the quality and efficiency of teaching and acquisition of knowledge (skills), monitored at the level of: (1) teachers, by accepting the suggestions of students and colleagues, (2) faculty, conducting the survey participants about the quality of teaching.		
Other (as the proposer wishes to add)			

Water Chemistry

<table>
<tr><td colspan="2">NAME OF THE COURSE</td><td colspan="6">Water Chemistry</td></tr>
<tr><td>Code</td><td>KTI204</td><td>Year of study</td><td colspan="5">2nd</td></tr>
<tr><td>Course teacher</td><td>PhD, Marijo Buzuk, assistent professor</td><td>Credits (ECTS)</td><td colspan="5">6.5</td></tr>
<tr><td rowspan="2">Associate teachers</td><td rowspan="2">PhD, Maša Buljac, assistant prof.</td><td rowspan="2">Type of instruction (number of hours)</td><td>L</td><td>S</td><td>E</td><td>F</td></tr>
<tr><td>30</td><td>15</td><td>30</td><td></td></tr>
<tr><td>Status of the course</td><td></td><td>Percentage of application of e-learning</td><td colspan="5"></td></tr>
<tr><td colspan="7">COURSE DESCRIPTION</td></tr>
<tr><td>Course objectives</td><td colspan="6">The main objective of this course is to understand the chemistry and kinetics that take place in natural waters (including the acid- base reactions in natural waters , complexation reactions , dissolution and precipitation , and redox reactions) for students of chemistry, biology, ecology, geochemistry, etc. In addition to these field of natural sciences, the course offers the fundamental knowledge necessary for understanding processes in environmental engineering.</td></tr>
<tr><td>Course enrolment requirements and entry competences required for the course</td><td colspan="6">It is required a good knowledge of general chemistry. Also, knowledge of analytical chemistry, physical chemistry, organic chemistry is useful but not obligates for understanding of lectures.</td></tr>
<tr><td>Learning outcomes expected at the level of the course (4 to 10 learning outcomes)</td><td colspan="6">After course students will be able to :
1. explain the water cycle and the interactions that occur between different phases (water - air, water - solid)
2. to explain carbonate equilibrium, to understand concepts of alkality and buffering capacity of water; to understand the differences in composition, origin of solutes between surface water, groundwater and sea. This includes understanding of pc - pH graphs for open and closed systems. In addition, students will get insight of origin of the sea composition and control of composition of river and sea water.
3. understanding the correlation between the complex reactions (coordination chemistry) and bio-availability and toxicity of metals. This includes creating inorganic complexes and the interaction of heavy metals with organic (mainly humic) substances.
4. understand and calculate equilibrium conditions which lead to deposition in natural waters. This includes the performance of pc - pH graphs in open and closed systems with or without solid phase .
5. to assume that important redox equations can take place in a real system and to develop pe (pE) - pH - pc diagram for chosen species.
6. understand biologically important redox equations that take place under different conditions in natural waters</td></tr>
<tr><td>Course content broken down in detail by weekly class schedule (syllabus)</td><td colspan="6">Lecture 1: Properties of water, structure of water molecules, the water composition (gases, compounds and ions in water , organic matter, trace elements , radioactive elements).
Lecture 2: The composition of sea water, the origin of salt and controls the composition of river and sea water elements in the sea (permanent elements , circuit elements (nutrients) adsorptive elements (precipitated elements) , ocean acidity).
Lecture 3: Interactions in the gas - water system , step changes</td></tr>
</table>

	Seminar 1 (2 hours): Model and conditions of steady surface film - Solving problems and examples **Lecture 4:** Carbonate system, Acid-base balance carbonate **Seminar 2 (2 hours):** Calculation of pH and composition of the solution to carbonate species, drawing p*c* - pH diagrams for open and closed system . **Lab course 1 (4 hours):** Introduction to methods of chemical analysis of water, Determination of total dissolved carbon, determination of dissolved inorganic carbon, determination of organic carbon **Lecture 5:** The concentration of carbonate species in open and closed systems, Akalitet and acidity (alkalinity and acidity) **Seminar 3 (2 hours):** Calculation of alkalinity in water of different composition and nature (sea, river, rain, consumer) **Lab course 2 (4 hours):** Determination of alkalinity various types of water (sea , river , rain) , Determination of total nitrogen and total dissolved nitrogen. **Lecture 6:** The metal ions in the aqueous solution , hydrolysis of the metal ion complexes with other inorganic ligands **Lecture 7:** The metal ions and humic substances , properties of humic substances , Interaction of humic substances with metals, water hardness **Lab course 3 (4 hours):** Determination of metals in water (calcium, potassium , sodium, iron, zinc) **Lecture 8:** Precipitation and dissolution equilibrium calculations , solubility and solubility product , conditional solubility product , log(*c*) pH diagrams (p*c* - pH) **Seminar 4 (2 hours):** Construction of PC - pH diagram for Ca^{2+} in equilibrium with the $Ca(OH)_2(s)$ and Mg^{2+} in equilibrium with $Mg(OH)_2(s)$ **Lecture 9:** Solubility of salts of weak acids and bases, complexing Effect on solubility , precipitation of $Fe(OH)_2(s)$ and $Fe(OH)_3(s)$ (p*c* - pH diagrams), dominating diagrams of species. **Seminar 5 (2 hours):** The precipitation of aluminum phosphate , Calculation of the equilibrium concentration of hydroxo complexes of iron , calcium carbonate solubility and stability of the water **Lecture 10:** Redox reactions in water, the standard potential, Electronic activity and p*e*, p*e*- p*c* diagrams **Seminar 6 (2 hours):** Construction of p*e* -p*c* (E-p*c*) diagrams (Fe species) **Lecture 11:** pe - pH diagrams for Cl2 , Other diagrams dominance (Br , I) , pe - pH (pH - *E*) plots in the presence of a of a solid phase **Seminar 7 (2 hours):** Construction of p*e* - pH (pH - *E*) diagrams for chloric and brominated species. Construction of p*e* - pH diagram for Fe^{2+} / Fe^{3+} in the presence of a solid phase **Lecture 12:** Chemistry of Iron, Iron in groundwater, Kinetics of oxidation of Fe^{2+} **Lecture 13:** The chemistry of chlorine, chlorine species equilibria, reactions of chlorine species with inorganic species **Lecture 14:** The reaction of chlorine with organic substances , with organic molecules containing N , reactions with phenols, trihalomethanes, reactions of oxidation **Exercise 4 (3 hours):** Determination of chlorine in water and diagram of chlorine species on the basis of experimental data. **Lecture 15:** Biologically important redox equations, nitrogen cycle, redox systems with micro-organisms, microbiological yield **Seminar 8 (1 hour):** p*c* - p*e* diagram for $c_{T,N}$ = 10-3 mol dm -3 in equilibrium with nitrogen (p_{N2} = 0.77 atm)	
Format of	×lectures	☐ndependent assignments

<table>
<tr><td>instruction</td><td colspan="3">×seminars and workshops
×exercises
☐on linein entirety
☐partial e-learning
☐field work</td><td colspan="3">☐multimedia
×laboratory
☐work with mentor
☐ (other)</td></tr>
<tr><td>Studentresponsibilities</td><td colspan="6"></td></tr>
<tr><td rowspan="6">Screening student work(name the proportion of ECTS credits for eachactivity so that the total number of ECTS credits is equal to the ECTS value of the course)</td><td>Class attendance</td><td>1.0</td><td>Research</td><td></td><td>Practical training</td><td></td></tr>
<tr><td>Experimental work</td><td>1.0</td><td>Report</td><td></td><td>(Other)</td><td></td></tr>
<tr><td>Essay</td><td></td><td>Seminar essay</td><td></td><td>(Other)</td><td></td></tr>
<tr><td>Tests</td><td></td><td>Oral exam</td><td>2.0</td><td>(Other)</td><td></td></tr>
<tr><td>Written exam</td><td>1.0</td><td>Project</td><td></td><td>(Other)</td><td></td></tr>
<tr><td colspan="6"></td></tr>
<tr><td>Grading and evaluating student work in class and at the final exam</td><td colspan="6">During semester two exams will be performed. Final examinations will be administered during formal examination periods. The following percentage equivalents apply to final grade: <55% Failure; 56%-66% (2); 67%-78% (3); 79%-90% (4);> 90% (5). After written exam, student will attend to oral exam. Lecturers do not give grades. Students earn grades.</td></tr>
<tr><td rowspan="10">Required literature (available in the library and 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">V.L. Snoeyink, D. Jenkins, Water Chemistry, Wiley, New York, 1980.

M. Buzuk, Kemija voda (u pripremi), Kemijsko-tehnološki fakultet, Split, 201X</td><td>0

X</td><td></td></tr>
<tr><td colspan="3"></td><td></td><td></td></tr>
<tr><td colspan="3">Vježbe iz Kemije voda (interna skripta u pripremi), Kemijsko-tehnološki fakultet, Split, 201X</td><td></td><td></td></tr>
<tr><td colspan="3"></td><td></td><td></td></tr>
<tr><td colspan="3"></td><td></td><td></td></tr>
<tr><td colspan="3"></td><td></td><td></td></tr>
<tr><td colspan="3"></td><td></td><td></td></tr>
<tr><td colspan="3"></td><td></td><td></td></tr>
<tr><td>Optional literature (at the time of submission of study programme proposal)</td><td colspan="6">W. Stumm, J.J. Morgan, Aquatic Chemistry, Chemical Equillibria and Rates in Natural Waters, 3th Wiley-Interscience, New York, 1996.</td></tr>
<tr><td>Quality assurance methods that ensure the acquisition of exit competences</td><td colspan="6"></td></tr>
<tr><td>Other (as the proposer wishes to add)</td><td colspan="6"></td></tr>
</table>

Microemulsions in applied chemistry

NAME OF THE COURSE	MICROEMULSIONS IN APPLIED CHEMISTRY					
Code	KTH216	Year of study	2.			
Course teacher	PhD, Vesna Sokol, associate prof.	Credits (ECTS)	3			
Associate teachers	PhD, Perica Bošković, assistant	Type of instruction (number of hours)	L	S	E	F
			15	15	30	
Status of the course	elective	Percentage of application of e-learning				
COURSE DESCRIPTION						
Course objectives	Emphasize to students the importance and width of the field of application of micro-emulsions in various industries such as food, pharmaceutical, cosmetic, textile, as well as in biomedicine, biotechnology and synthesis of nanoparticles. Acquisition of fundamental knowledge on the physico-chemical properties of conventional microemulsion and surfactant-free-microemulsion systems based on green chemistry.					
Course enrolment requirements and entry competences required for the course						
Learning outcomes expected at the level of the course (4 to 10 learning outcomes)	Students will be able to successfully master the subject: - to describe the structure of classical microemulsions and microemulsion systems without the presence of a surfactant so-called “Surfactant-Free-Microemulsions”; to define the differences in comparison to emulsion -to explain the role of the surfactant and the importance of thermodynamic parameters in achieving a stable microemulsion system - to determine the size and shape of the microemulsion aggregates and explain the dynamics of their growth - to describe the basic principles and possibilities for application of different methods (spectroscopy, conductometrics, measuring viscosity, surface tension measurement, AFM, TEM, SANS) in the study of microemulsion systems - to recognize the principles on which Green Chemistry reduces the negative effects of chemical processes and technologies on the environment - to plan the laboratory procedures and independently to conduct an experiment in accordance with the plan of research - to implement appropriate computer programs for numerical processing of experimental data and graphic representation of the results obtained; discuss the results and reach a conclusion at the end					
Course content broken down in detail by weekly class schedule (syllabus)	Lectures: Week 1.: Introduction to microemulsion. Week 2.: Characteristics and structure of microemulsion. Week 3.: Differences between microemulsions and emulsions. Week 4.: Conditions of of phase equilibrium and phase diagrams. Week 5.: The surfactants and co-surfactants, and their characteristics. 6. and 7. week: Rheology of microemulsion and emulsion systems. Week 8.: First partial exam. 9. and 10. week: Methods and experimental techniques of research microemulsion					

<table>
<tr><td></td><td colspan="6">system.
Week 11.: Surface tension and critical micelle concentration (c.m.c.).
Week 12: The microstructure of microemulsion aggregates.
Week 13.: The microemulsions without the presence of surfactant (“Surfactant-Free-Microemulsions”).
Week 14.: The application of microemulsion. Examples.
Week 15.: The second partial exam.

Laboratory exercises:
1.Ternary phase diagram - determination of characteristic areas of microemulsion system.
2. Conductometric determination of critical micelle concentration (c.m.c.) and thermodynamics of micellization reaction in the presence of surfactant.
3. Determination of solvation properties of microemulsion using UV-Vis spectroscopy - extraction efficiency of toxic analytes from contaminated soil and comparison with conventional solvents.
4. Conductometric determination of nanostructures in the microemulsion without the presence of surfactants.
5. Viscometric determining of percolating threshold of microemulsion system. Size and shape of microemulsion aggregates.

Seminar
Student will present the selected topic from the subject content in written form by seminar paper and oral presentation in PowerPoint.</td></tr>
<tr><td>Format of instruction</td><td colspan="6">x lectures
x seminars and workshops
x exercises
□ on line in entirety
□ partial e-learning
□ field work
x independent assignments
x multimedia
x laboratory
□ work with mentor
□ (other)</td></tr>
<tr><td>Student responsibilities</td><td colspan="6">Students are required to attend classes and actively participate in the teaching process. This will be recorded and evaluated in making a final assessment.</td></tr>
<tr><td rowspan="6">Screening student work(name the proportion of ECTS credits for eachactivity so that the total number of ECTS credits is equal to the ECTS value of the course)</td><td>Class attendance</td><td>0.5</td><td>Research</td><td></td><td>Practical training</td><td>0.5</td></tr>
<tr><td>Experimental work</td><td>1</td><td>Report</td><td></td><td>(Other)</td><td></td></tr>
<tr><td>Essay</td><td></td><td>Seminar essay</td><td>1</td><td>(Other)</td><td></td></tr>
<tr><td>Tests</td><td></td><td>Oral exam</td><td></td><td>(Other)</td><td></td></tr>
<tr><td>Written exam</td><td></td><td>Project</td><td></td><td>(Other)</td><td></td></tr>
<tr><td></td><td colspan="6"></td></tr>
<tr><td>Grading and evaluating student work in class and at the final exam</td><td colspan="6">The course content is divided into two units that students take over partial exams or joining final exam at the end of the semester. The exam is considered passed if students achieve at least 60%. The final grade is based on the evaluation of partial exams. Grades: <60% not satisfied; 60-69% successful (2) 70-79% good (3), 80-89% very good (4), 90-100% excellent (5).</td></tr>
<tr><td rowspan="2">Required literature (available in the library and 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">R. Najjar, Microemulsions - An Introduction to</td><td></td><td colspan="2">1</td></tr>
</table>

	Properties and Applications, InTech, 2012.		
	C. Sell, The Chemistry of Fragrances-From Perfumer to Consumer, RSC Publishing, Ashford,UK, 2006.		1
	P. K. Bidyut, S.P. Moulik, Uses and applications of Microemulsions, Curr. Sci. 80 (2001) 990.		1
Optional literature (at the time of submission of study programme proposal)	P. Bošković, V. Sokol, T. Zemb, D. Touraud, W. Kunz. Weak Micelle-Like Aggregation in Ternary Liquid Mixtures as Revealed by Conductivity, Surface Tension, and Light Scattering, J. Phys. Chem. B 119 (2015) 9933. I. Kralova, J. Sjöblom Surfactants Used in Food Industry: A Review, J. Disper. Sci. Technol. 30 (2009) 1363. J. Drapeau, M. Verdier, D. Touraud, U. Kröckel, M. Geier, A. Rose, W. Kunz, Effective Insect Repellent Formulation in both Surfactantless and Classical Microemulsions with a Long-Lasting Protection for Human Beings, Chem. Biodivers. 6 (2009) 934. C. A. Katz, Z. J. Calzola, J. K. N. Mbindyo, Structure and Solvent Properties of Microemulsions, J. Chem. Educ. 85 (2008) 263. K. Holmberg, B. Jönsson, B. Kronberg, B. Lindman, Surfactants and polymers in aqueous solutions, John Wiley and Sons, Chichester, 2003. J.L. Salager, Surfactants: Types and Uses, Universidad de los Andes, 2002.		
Quality assurance methods that ensure the acquisition of exit competences	Quality of the teaching and learning, monitored at the level of the (1) teachers, accepting suggestions of students and colleagues, and (2) faculty, conducting surveys of students on teaching quality.		
Other (as the proposer wishes to add)			

Selected chapters from biochemistry

<table>
<tr><td colspan="2">NAME OF THE COURSE</td><td colspan="5">SELECTED CHAPTERS FROM BIOCHEMISTRY</td></tr>
<tr><td>Code</td><td>KTH217</td><td>Year of study</td><td colspan="4"></td></tr>
<tr><td>Course teacher</td><td>PhD, Olivera Politeo, associate prof.</td><td>Credits (ECTS)</td><td colspan="4">4 ECTS</td></tr>
<tr><td rowspan="2">Associate teachers</td><td rowspan="2"></td><td rowspan="2">Type of instruction (number of hours)</td><td>L</td><td>S</td><td>E</td><td>F</td></tr>
<tr><td>30</td><td>15</td><td>-</td><td>-</td></tr>
<tr><td>Status of the course</td><td>elective</td><td>Percentage of application of e-learning</td><td colspan="4"></td></tr>
<tr><td colspan="7">COURSE DESCRIPTION</td></tr>
<tr><td>Course objectives</td><td colspan="6">The goal of this course is to teach students aboth specific and and important topics in the field of biochemistry .</td></tr>
<tr><td>Course enrolment requirements and entry competences required for the course</td><td colspan="6">Biochemistry I and Biochemistry II</td></tr>
<tr><td>Learning outcomes expected at the level of the course (4 to 10 learning outcomes)</td><td colspan="6">• Introduction to the structure and function of muscle tissue and cytoskeleton as well as functions of blood cells, plasma proteins and immunoglobulins.
• Understand the significance of acid-base balance in the body and buffers involved in its maintenance.
• Understand the significance of oxidative processes in the body and the antioxidant systems and methods.
• Learn about metabolism of fructose, galactose and mannose.
• Learn about hormons, signal transduction and lipid second messengers.
• Learn about other products of amino acids metabolism. Learn about porphyrin and heme metabolism and disorders connected with their metabolism.
• Understand the significance of nutrition, digestion and absorption of nutrients as well as micronutrients.
• Understand the significance of glycosylation and glycoproteins.
• Learn about xenobiotic metabolism and bioinformatics.</td></tr>
<tr><td>Course content broken down in detail by weekly class schedule (syllabus)</td><td colspan="6">LECTURES:
Muscle tissue and cytoskeleton. Blood cells. (2) Plasma proteins and Immunoglobulins.(2) Acid-base balance. (2) Biological Oxidation. Free Radicals. Antioxidants. (4) Metabolism of Other Hexoses.(2) Hormons and signal transduction.(2) Lipid Second Messengers (2) Other products of amino acids metabolism. (2) Porphyrin and Heme Metabolism (2) Micronutrients: Vitamins and Minerals. (2) Nutrition, digestion and absorption.(2) Glycoproteins. (2) Xenobiotic Metabolism. (2) Bioinformatics. (2)

SEMINARS:
Students will review and process the topics related to pathological conditions resulting from biochemical disorders.</td></tr>
<tr><td>Format of instruction</td><td colspan="3">□lectures
□exercises</td><td colspan="3"></td></tr>
<tr><td>Student responsibilities</td><td colspan="6">Class attendance, attending to experimental work and taking the final exam</td></tr>
</table>

Screening student work(*name the proportion of ECTS credits for eachactivity so that the total number of ECTS credits is equal to the ECTS value of the course)*	Class attendance	0,5	Research		Practical training	
	Experimental work		Report		(Other)	
	Essay		Seminar essay	**1**	(Other)	
	Tests	0,5	Oral exam		(Other)	
	Written exam	1	Project		(Other)	
Grading and evaluating student work in class and at the final exam	Class attendance, preparing seminar papers and taking the final exam.					

	Title	**Number of copies in the library**	**Availability via other media**
Required literature (available in the library and via other media)	R.M.Murray i sur: Harperova ilustrurana biokemija, 28th Ed, Medicinska naklada, Zagreb 2011.		
	J.M. Berg, J.L. Tymoczko, L. Stryer: Biokemija, 5th Ed, Školska knjiga Zagreb, 2013.		
	D. Čvorišćec i I. Čapelak (ur.): Štrausova medicinska biokemija. Medicinska naklada, 2009, Zagreb.		
	N. V. Bhagavan,Chung-Eun Ha: Essential of medicinal biochemistry: with clinical cases, Second Edition, Academic Press 2015, San Diegi, CA, USA.		

Optional literature (at the time of submission of study programme proposal)	D. Voet, J.G.Voet, C.W.Pratt: *Fundamental of Biochemistry*, Jonn Wiley & Sons Inc., NY, Chichester, Weinheim, Brisbane, Singapore, Toronto,1999 G. M. Cooper, R. E. Hausman. Stanica. 5.izdanje. 2010
Quality assurance methods that ensure the acquisition of exit competences	Monitoring of quality assurance will be performed at three levels: (1) University, (2) Faculty Level by Quality Control Committee, (3) Level of teachers.
Other (as the proposer wishes to add)	

Chemical sensors and biosensors

NAME OF THE COURSE	Chemical sensors and biosensors					
Code	KTH218	Year of study	2st year of graduate study			
Course teacher	PhD, Marijo Buzuk, assistant prof.	Credits (ECTS)	4			
Associate teachers		Type of instruction (number of hours)	P	S	V	T
			30	0	15	
Status of the course	Election	Percentage of application of e-learning				

OPIS PREDMETA	
Course objectives	Students will get insight into actual achievements in chemical and biochemical sensing systems. Basic principles and kind of chemical and biochemical sensor systems will be presented together with problems that can arise during development process of such sensors systems (sensors material or biomaterial, recognition mechanism, choosing appropriate transducer element, configuration and practical development of sensors. Furthermore, practical applicability of chemical sensors and biosensors in medical, industrial and environmental analysis will be given.
Course enrolment requirements and entry competences required for the course	-
Learning outcomes expected at the level of the course (4 to 10 learning outcomes)	1. To recognize and characterize sensors systems. 2. To propose and to development novel sensors systems, together with improvement of current ones. 3. To use a knowledge in selection of appropriate sensors systems for various analytes in different area of application. 4. To get specific insight into recognition principles, amplification and transduction of chemical signal into various outcome signals.
Course content broken down in detail by weekly class schedule (syllabus)	1. General aspects and introduction in chemical sensors and biosensors-definition, terminology. Classification of sensors (electrochemical, optical, piezoelectrical, termal, aqoustic). Phenomenon (recognition mechanism) that can be applied in sensors systems. Novel trends and scopes in sensors development (nanotechnology, nanostructure, "smart" sensors, *in vivio* sensors) 2. Basic construction concepts of sensors and biosensors. Example of commercial sensors and biosensors (ion-selective electrodes, glucometer, Elisa assay). Chemical and biochemical recognition mechanism. Recognition elements: ionophores, enzymes, crystals. Criterion for recognition elements selection. Biochemical selectivity and stability of recognition elements-problems. 3. Matrix material of sensors. Role and characteristics of matrixes. Recognition element immobilization methods. Incorporation of recognition elements into various matrixes (gels, polymers: conducting or non-conducting, carbon materials: paste, screen-printing, carbon nanotubes). Covalent binding of enzymes, cross-linking, physical adsorption. 4. Transducer for electrochemical, optical, piezoelectrical sensors. Selection of transducing element. Electrochemical sensors: potentiometric, amperometric.

	Modiffied electrodes. Preparation of ion-selective electrodes-techniques. Conducting surface, modified layer, signal transducing. Microelectrodes, FET sensors. 5. Optical sensors. Absorption, UV absorption, reflectometry, luminescence. Optical fibers sensors. Intrinsic and extrinsic sensors. Application of optical sensors in sensing of pH, pressure, temperature, humidity. Determination of biomolecules with optical sensors-luciferase in ATP detection and bacterial redox systems with luciferase in NADPH detection. 6. Piezoelectrical sensors. General aspects. Acoustic sensors. Incorporation of recognition elements. 7. Biosensors. Electrochemical, optical, immunosensors, optical sensors. First, second and third generation of biosensors. 8. Examples of the three generation of biosensonsors-amperometric determination of glucose. Redox interference. Oxygen dependence of the signal. Peroxide role. *in vitro* and *in vivo* continuously monitoring of glucose. Modern scopes in development of glucometers. Commercialization of sensors. 9. Immunosensors. Antibody-antigen bonding as mechanism of recognition. Electrochemical, optical, immunosensors, optical immunosensors. Examples of immunosensors for hemoglobin, erythrocytes, t-lymphocytes, viruses and bacterial. ELISA test. 10. DNA detection. DNA electrochemical sensors. Electrochemistry of DNA and detection principles. Immobilization of DNA sequences onto different materials. Electrodes processes-hybridization. Enzyme labeled DNA sequences. 11. Bionseors for pesticide detection. Enzymes used for pesticide detection. Basic concepts. Inhibition mechanism. Catalytically based biosensors. Immunosensors for pesticides determination. Enzymes reactivation. Microorganism, issue, cells as recognition elements. 12. Nanomaterial in optical and electrochemical biosensors. Carbon nanotubes (CNT) in biosensors preparation. CNT composite materials. 13. Introduction in direct transfer of electrons by proteins. Protein immobilization techniques. Examples: cytochrome c, myoglobine, hemoglobine. Role of CNT. Direct electron transfer from enzyme onto electrode. Examples: glucose oxidase, catalase, HRP. 14. Evaluation of sensors: selectivity, sensitivity, reproducibility, repeatability. Other types of sensors: impedance sensors, sensors for gases. 15. Highly sophisticated sensors systems: microelectro-machanical systems (MEMS and Bio(MEMS)), Lab-on-a-chip, nanosensors, biochips. Lab courses: 1. Preparation of potentiometric sensors by incorporation of ionophores in polymer matrix. Components ratio influences onto sensor characteristics. Determination of heavy metals in water. Selectivity of prepared sensor. 2. Amperometric determination of amino acids onto crystal and bismuth modified electrodes. Electrode preparation, characterization, influences of parameters on signal quality. 3. Preparation of the biosensors for determination of glucose. Incorporation of glucoso oxidase into carbon paste. MnO_2 as transducing element. Interferences. Role of Nafion® in improvment of the signal. Determination of glucose in real samples	
Format of	x lectures	☐ independent assignments

<table>
<tr><td>instruction</td><td colspan="6">☐ seminars and workshops
x exercises
☐ on line in entirety
☐ partial e-learning
☐ field work</td><td colspan="2">☐ multimedia
x laboratory
☐ work with mentor
☐ (other)</td></tr>
<tr><td>Student responsibilities</td><td colspan="8">The 80% presence at lectures and completed all laboratory exercises.</td></tr>
<tr><td rowspan="5">Screening student work (name the proportion of ECTS credits for each activity so that the total number of ECTS credits is equal to the ECTS value of the course)</td><td>Class attendance</td><td>1</td><td>Research</td><td></td><td>Practical training</td><td></td></tr>
<tr><td>Experimental work</td><td>1</td><td>Report</td><td></td><td>(Other)</td><td></td></tr>
<tr><td>Essay</td><td></td><td>Seminar essay</td><td>0.5</td><td>(Other)</td><td></td></tr>
<tr><td>Tests</td><td></td><td>Oral exam</td><td></td><td>(Other)</td><td></td></tr>
<tr><td>Written exam</td><td>0.5</td><td>Project</td><td></td><td>(Other)</td><td></td></tr>
<tr><td>Grading and evaluating student work in class and at the final exam</td><td colspan="8">Prior to joining the laboratory exercises, students' knowledge of the material concerned exercises will be verified by tests. All exercises must be completed.
The exam consists of a written examination. The written part of the exam lasts two hours. The written part of the exam is evaluated as follows:
Exactly solved more than 55 % - sufficient
Exactly solved more than 70 % - good
Exactly solved more than 80 % - very good
Exactly solved more than 90 % - excellent

A complete examination or part thereof may be installed through two partial tests during the semester. The tests cover material presented in lectures and lab courses. Written tests are evaluated in the following manner:
Exactly solved more than 55 % - released a written exam
Exactly solved by 60 % - freed written and oral - sufficient
Exactly solved by 70 % - freed written and oral - good
Exactly solved by 80 % - freed written and oral - very good
Exactly solved by 90 % - freed written and oral - excellent
It is necessary to pass all tests in order to pass the exam. Students who did not meet any of the tests must take written and oral exam of that part.
Also, essays make a basis for discussions and are rooted in the central parts of the syllabus for the course in question. Essays can be written on the basis of the course literature and lectures and will be presented to all course participants.</td></tr>
<tr><td rowspan="3">Required literature (available in the library and via other media)</td><td colspan="6">Title</td><td>Number of copies in the library</td><td>Availability via other media</td></tr>
<tr><td colspan="6">Florinel-Gabriel Bănică, Chemical Sensors and Biosensors: Fundamentals and Applications, John Wiley & Sons, Ltd, 2012.</td><td></td><td></td></tr>
<tr><td colspan="6">E. Palecek, F. Scheller, J. Wang Electrochemistry of Nucleic Acids and Proteins, Elsevier, 2005.</td><td></td><td></td></tr>
</table>

	Xueji Zhang, Huangxian Ju, Joseph Wang, Electrochemical Sensors, Biosensors and Their Biomedical Applications, Elsevier, 2008.		
	E. Turkušić, Uvod u hemijske senzore i biosenzore, PMF Sarajevo, 2012		
Optional literature (at the time of submission of study programme proposal)	a.		
Quality assurance methods that ensure the acquisition of exit competences	- Information from interviews, observations, and consultation with students during lectures - Student survey		
Other (as the proposer wishes to add)			

Environmental Menagment System

NAME OF THE COURSE	Environmental Menagment System					
Code	KTH205	Year of study	2nd			
Course teacher	PhD, Marijo Buzuk, assistant prof.	Credits (ECTS)	6.0			
Associate teachers	PhD, Maša Buljac, assistant prof.	Type of instruction (number of hours)	L	S	E	F
			30	15	30	
Status of the course	Optional	Percentage of application of e-learning				
COURSE DESCRIPTION						
Course objectives	The main objective of this course is an introducing students to the steps and processes during the implementation of the ISO 14001 standard in business subjects and in possible problems that arising from the implementation process and to resolve issue. Furthermore, one of the goals of this course is to introduce students to the development and future trends in the development of international norms that it is needed for understanding and applying them in various systems.					
Course enrolment requirements and entry competences required for the course	None					
Learning outcomes expected at the level of the course (4 to 10 learning outcomes)	1. Students will understand the concept of integrated environmental protection, sustainable development, and will have ability to measure and proceed for the protection of the environment. 2. Based on the previous point, students will be able to participate in area planning, according to principles of sustainable development and to be able to estimate the impact on the environment (either Strategic Impact Assessment or any estimation of the environmental impact). 3. Students will have the ability to estimate risk and to manage it, as well as its the quantitative and qualitative representation. 4. Students will be able to participate in the process of planning and management of environment, relating to the study of the environmental impact, and therefore in the Commission for Strategic Studies and Environmental Strategy. 5. By discussing about the Regulations on Environmental Impact Estimation and the steps in the preparation of studies, students will gain knowledge that is inevitable in implementation of various Estimation and Environmental Programme. 6. Students will acquire the competencies that will provide them as experts in selecting the best available technique for a specific activity according to the European guidelines . They will be able to identify and resolve nonconformities that occur during this process . 7. Students will be able to apply the knowledge in organizations that have implemented an Environmental Management System ISO 14001 , and in the segment with its maintenance and improvement. 8. Students will acquire knowledge that will enable them to be an important subjects and managers to establish the system of ISO 14001 in various subjects. 9. Students will be able to apply the knowledge for implementation,					

	maintenance and development of EMS.
Course content broken down in detail by weekly class schedule (syllabus)	**Lecture 1:** The definition of technology ; similarities and differences ; historical development of the term . Impacts and Challenges of technology . The separations technology. **Lecture 2:** Definition ecosystem, classification. Environment Protecting the environment. Pollution and contamination. Legal provisions in the RH. **Lecture 3:** Sustainable Development; concepts, vision, future. Sustainable development laws of thermodynamics. The path towards sustainable development. **Lecture 4:** Types of Environmental Protection. Integrated approach. The measures and procedures to protect the environment. The political and sociological approach, legal measures. **Lecture 5:** Planning and management of the area. Basic documents of Environmental Protection. The environmental impact assessment. Risk management. Cost-benefit analysis. **Seminar and Exercise 1 (2 × 4 hours):** Consideration and discussion of objectives and approach strategies, programs, studies on the process of planning and environment management. **Lecture 6:** A study of the environmental impact - steps in the preparation . Legal provisions. **Seminar and Practice 2 (2 × 4 hours):** Consideration and discussion of goals and approach to the study of the environmental impact. The debate about the roles of various professionals, overlapping powers and competencies, and suggestions dismissal of the non-compliance! The interest of the community vs. capital interest. **Lecture 7:** Methodology of the best available techniques. **Seminar and Exercise 3 (2 × 4 hours):** A critical review of the methodology for the assessment of best available techniques - debates , discussions, debates , proposals . Development of algorithms and schemes for assessing best available techniques. **Seminar and Exercise 4 (2 × 4 hours):** Evaluating and choosing the best available techniques for different procedures with the help of the guidelines . Landfills, waste gases , waste incinerators , cement industry , etc .... **Lecture 8:** Systems - definition. Standards and Standardization. Croatian Standards Institute. Accreditation and certification. Types of norms. **Lecture 9:** ISO. ISO 14001 Environmental Policy. Plan. **Seminar and Exercise 5 (2 × 4 hours):** Development of ISO 14001 on examples of different organizations. Environmental policy. Plan. **Lecture 10:** ISO 14001 Implementation and operational phases. Testing and verification. **Seminar and Exercise 6 (2 × 5 hours):** Development of ISO 14001 on examples of different organizations. Implementation and operational phases. Testing and verification. **Lecture 11:** The definition of quality. Family 9001 standard procedure of introducing a system of quality. **Lecture 12:** General requirements of quality management systems and requirements relating to documentation. **Lecture 13:** ISO 9001 Document Control and inspection records. Management responsibility and quality policy. **Lecture 14:** Planning Quality Management System. Resource management. Control and improve the system. Self-evaluation. **Lecture 15:** Integration of standards 14001 and 9001 in a joint management system. Similarities and differences .

<table>
<tr><td></td><td colspan="6">Seminar and Exercise 7 (2 × 5 hours): Integration of standards 14001 and 9001 in a joint management system for the various economic operators.</td></tr>
<tr><td>Format of instruction</td><td colspan="3">×lectures
×seminars and workshops
☐exercises
☐on linein entirety
☐partial e-learning
☐field work</td><td colspan="3">×independent assignments
☐multimedia
☐laboratory
☐work with mentor
☐ (other)</td></tr>
<tr><td>Student responsibilities</td><td colspan="6"></td></tr>
<tr><td rowspan="6">Screening student work(name the proportion of ECTS credits for eachactivity so that the total number of ECTS credits is equal to the ECTS value of the course)</td><td>Class attendance</td><td>2.0</td><td>Research</td><td></td><td>Practical training</td><td></td></tr>
<tr><td>Experimental work</td><td></td><td>Report</td><td></td><td>(Other)</td><td></td></tr>
<tr><td>Essay</td><td></td><td>Seminar essay</td><td>1.0</td><td>(Other)</td><td></td></tr>
<tr><td>Tests</td><td></td><td>Oral exam</td><td>1.0</td><td>(Other)</td><td></td></tr>
<tr><td>Written exam</td><td>2.0</td><td>Project</td><td></td><td>(Other)</td><td></td></tr>
<tr><td colspan="6"></td></tr>
<tr><td>Grading and evaluating student work in class and at the final exam</td><td colspan="6">During semester two exams will be performed. Final examinations will be administered during formal examination periods. The following percentage equivalents apply to final grade: <55% Failure; 56%-66% (2); 67%-78% (3); 79%-90% (4);> 90% (5). After written exam, student will attend to oral exam. Lecturers do not give grades. Students earn grades.</td></tr>
<tr><td rowspan="5">Required literature (available in the library and 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">M. Buzuk, Sustavi upravljanja okolišem (u pripremi), Kemijsko-tehnološki fakultet, Split, 201X</td><td>0

X</td><td>personal</td></tr>
<tr><td colspan="3">Tonći Lazibat, Poznavanje robe i upravljanje kvalitetom, Sinergija, Zagreb, 2005.</td><td></td><td>by mail</td></tr>
<tr><td colspan="3">Smjernice za najbolje raspoložive tehnike MZOIP</td><td></td><td>www</td></tr>
<tr><td colspan="3"></td><td></td><td></td></tr>
<tr><td>Optional literature (at the time of submission of study programme proposal)</td><td colspan="6"></td></tr>
<tr><td>Quality assurance methods that ensure the acquisition of exit competences</td><td colspan="6"></td></tr>
<tr><td>Other (as the proposer wishes to add)</td><td colspan="6"></td></tr>
</table>

Solid State Chemistry

NAME OF THE COURSE	Solid State Chemistry					
Code	KTI207	Year of study	2nd			
Course teacher	PhD, Slobodan Brinić, associate prof.	Credits (ECTS)	6.0			
Associate teachers		Type of instruction (number of hours)	L	S	E	F
			30	15	30	
Status of the course	Election	Percentage of application of e-learning				

COURSE DESCRIPTION

Course objectives	To obtain the knowledge on design and development of materials with pre-required properties based on understanding the structure of solids in its influence on physical-chemical properties, understanding of phase relations, chemical synthesis, reaction kinetics as well as characterisation methods.
Course enrolment requirements and entry competences required for the course	Taken and passed courses in General Chemistry and Inorganic Chemistry
Learning outcomes expected at the level of the course (4 to 10 learning outcomes)	After the the course students will be able to: • Understand and use the terminology of crystallography • Identify the structure of crystalline compounds • Assess the characteristics of solids based on the knowledge of its structure • Understand and describe the techniques of synthesis and preparation of materials • Understand and describe the structure of materials characterization techniques
Course content broken down in detail by weekly class schedule (syllabus)	1. lecture: Properties of solid substances, types of bonds in solids - the impact of bonded and non-bonded electrons on the structure and properties of solids. 2. lecture: The structure of metals and alloys. Metal bond theory. Theory of semiconductors and insulators. Superconductivity. 3. lecture: The crystallographic systems - Bravais grid, Miller indices, common crystal structures, 4. lecture: Types of crystal defects and their impact on material properties 5. lecture: Structure is not crystal - amorphous materials, glass, glass-ceramic, metallic glasses 6. lecture: Electrical properties of materials (thermoelectric effects, piezo-, pyro- and ferroelektricity). 7. lecture: Magnetic properties of materials (paramagnetism, ferro-, feri- and anti-ferromagnetism, structure and properties of magnetic materials). 8. lecture: Optical properties (luminescence, lasers). Crystal imperfections and non-stoichiometry. Diffusion. 9. lecture: Ionic conductivity, solid electrolytes. 10. lecture: Phase diagrams and phase transitions (thermodynamics and kinetics) 11. lecture: Synthesis and preparation of materials - particles, films, coatings, single crystals, nanomaterials and composites, physical processes and reaction kinetics, microstructure development, self-organizing structures and macrostructures 12. lecture: Basic methods of characterization of solids, electron microscopy and diffraction, X-ray diffraction, thermal analysis, spectroscopic methods
Format of instruction	x lectures x seminars and workshops x exercises	☐ independent assignments ☐ multimedia x laboratory

	☐ *on line* in entirety ☐ partial e-learning ☐0 field work	☐ work with mentor ☐ (other)
Student responsibilities	The 80% presence at lectures and seminars, and completed all laboratory exercises.	

Screening student work *(name the proportion of ECTS credits for each activity so that the total number of ECTS credits is equal to the ECTS value of the course)*						
	Class attendance	2.0	Research		Practical training	
	Experimental work	2.0	Report		(Other)	
	Essay		Seminar essay		(Other)	
	Tests		Oral exam	1.0	(Other)	
	Written exam	1.0	Project		(Other)	

Grading and evaluating student work in class and at the final exam	Prior to joining the laboratory exercises, students' knowledge of the material concerned exercises will be verified by tests. All exercises must be completed. Students who obtain a signature from the course Solid State Chemistry can take the exam. The exam consists of a written and oral examination. The student approached the oral exam must first pass a written examination. The written part of the exam lasts two hours. The written part of the exam is evaluated as follows : Exactly solved more than 55 % - sufficient Exactly solved more than 70 % - good Exactly solved more than 80 % - very good Exactly solved more than 90 % - excellent After the written exam on the notice board of the Department will be advertised results of the exam and time when students which did not pass the written exam can view tasks and schedule for oral examinations for students which have acquired this right. A complete examination or part thereof may be installed through two partial tests during the semester. The tests cover material presented in lectures, seminars and exercises. Written tests are evaluated in the following manner: Exactly solved more than 55 % - released a written exam Exactly solved by 60 % - freed written and oral - sufficient Exactly solved by 70 % - freed written and oral - good Exactly solved by 80 % - freed written and oral - very good Exactly solved by 90 % - freed written and oral - excellent It is necessary to pass all tests in order to pass the exam. Students who did not meet any of the tests must take written and oral exam of that part.

	Title	**Number of copies in the library**	**Availability via other media**
Required literature (available in the library and via other media)	A.R. West, Basic Solid State Chemistry, 2nd Ed., John Wiley & Sons, New York, 1999.		
	C.N.R. Rao, J. Gopalakrishnan, New Direction in Solid State Chemistry, 2nd Ed., Cambridge University Press, Cambridge, 1997.		
	Brinić, Slobodan: „Predavanja iz Kemije čvrstog stanja“		web http://www.ktf-split.hr
Optional literature (at the time of submission of study programme proposal)	A. K. Cheetham, P. Day, Solid State Chemistry: Techniques, Reprint edition, Oxford University Press; 1990.		

Quality assurance methods that ensure the acquisition of exit competences	- Information from interviews, observations, and consultation with students during lectures - Student survey
Other (as the proposer wishes to add)	

Chemistry and Technology of Aromatic Plants

NAME OF THE COURSE	Chemistry and Technology of Aromatic Plants					
Code	KTI205	Year of study	2nd			
Course teacher	PhD, Igor Jerković, prof.	Credits (ECTS)	6.0			
Associate teachers	assistant	Type of instruction (number of hours)	L	S	E	F
			30	15	30	
Status of the course	obligatory	Percentage of application of e-learning				

COURSE DESCRIPTION	
Course objectives	Acquisition of basic knowledge on the chemistry and technology of aromatic plants, knowledge of the structures of organic compounds typical for the essential oils, their division and useful properties, knowledge on the biosynthesis of essential oils and methods of their isolation and identification of the oil components.
Course enrolment requirements and entry competences required for the course	-
Learning outcomes expected at the level of the course (4 to 10 learning outcomes)	After passing the course, students will be able to: • describe the basic concepts, essential oils, aromatic plants processing procedures, analyses of isolates obtained and typical use of essential oils • illustrate the ways of smell perception, the biosynthesis of terpenes and other compounds of essential oils, the basic division of terpenes • demonstrate basic procedures in the processing of aromatic plants, simple method for isolation of essential oils and aromatic extracts preparation • determine the appropriate method of analysis of derived isolates (basic physical and chemical values, the application of chromatographic and spectroscopic methods) • propose suitable procedures for the processing of aromatic plants, taking into account the fundamental principles of distillation and extraction procedures, the analysis of obtained isolates considering the possibility of artefacts formation as well as structural / biosynthetic relationship between the isolated compounds • choose the correct chemical approach for solving problems in the field of chemistry and technology of aromatic plants, starting from the acquired knowledge from organic chemistry and biochemistry
Course content broken down in detail by weekly class schedule (syllabus)	**Introduction to aromatic plants and essential oils** - definition, historical development of isolation and research of the essential oils. (3 hours); Natural, natural identical and synthetic essential oils; chemical structures of molecules and smell; activating receptors of smell: ion channels and G-proteins; essential oils in plants, plant formations for storage of the essential oils, chemotaxonomy and chemotypes of essential oils (3 hours). **Chemical composition of the essential oils**: terpenes, isoprene rule, division, cyclic and acyclic structures of mono- and sesquiterpenes; phenylpropanoic derivatives and other compounds in the essential oils (3 hours); Chirality and structures of terpenes; glycosidically bound volatile compounds; the basic structure of glycones and aglycones of the glycosides of volatile compounds; Biogenesis of 3-IPP via mevalonic acid; biogenesis 3-IPP over deoxyxylulose phosphate (DXP) (3 hours); Biogenetic isoprene rule - the precursors of terpenes (GPP, FPP, GGPP);

<table>
<tr><td></td><td colspan="6">biogenesis semiterpenes, acyclic and cyclic mono-and sesquiterpenes. (3 hours)
Processing of aromatic plants: drying and storage; general overview of the methods of isolation and concentration of the essential oils; rate of distillation – hydrodiffusion; hydrolysis and decomposition of labile components of essential oils (3 hours); **Hydrodistillation, water-vapour and steam distillation** in the laboratory and in industry; comparison of water, water-steam and steam distillation (3 hours); **Extraction with organic solvents, extraction with cold and hot fat**; overview of the types of the obtained aromatic extracts; **extraction with sub-and supercritical fluids** (CO_2, H_2O); **microwave extraction**; **simultaneous distillation-extraction** (3 hours); Comparison of conventional and new extraction techniques; fractionation of the essential oils; basic physical and chemical values of the essential oils; chromatographic techniques in the analysis of essential oil (3 hours)
TLC and GC analysis of the essential oil, detectors (FID and MS), types of columns, sample preparation for the analysis of essential oil, retention time and the index, an overlap of peaks and fractionation of essential oils (pre-treatment) (3 hours); Modern chromatographic techniques in the analysis of essential oils: chiral GC, HSGC, MDGC, 2DGC; GC-MS; MS (SIM SCAN technique) - identification of terpenes and phenylpropane derivatives via MS (6 hours)
Overview of common essential oils - chemical composition and application (6 hours); the use of essential oils; mechanism of antibacterial and antioxidant activity; the structure of biologically active compounds of essential oils; undesirable effects of the essential oils (3 hours)</td></tr>
<tr><td>Format of instruction</td><td colspan="3">**X** lectures
X seminars and workshops
X exercises
☐ *on line* in entirety
☐ partial e-learning
☐ field work</td><td colspan="3">☐ independent assignments
☐ multimedia
☐ laboratory
☐ work with mentor
☐(other)</td></tr>
<tr><td>Student responsibilities</td><td colspan="6">Students are required to attend classes (lectures and seminars) and actively participate in the teaching process, which will be evaluated in the final assessment by the weight coefficient of 5%.</td></tr>
<tr><td rowspan="5">Screening student work(name the proportion of ECTS credits for eachactivity so that the total number of ECTS credits is equal to the ECTS value of the course)</td><td>Class attendance</td><td>0.5</td><td>Research</td><td>0</td><td>Practical training</td><td>0</td></tr>
<tr><td>Experimental work</td><td>1.0</td><td>Report</td><td>0</td><td>(Other)</td><td></td></tr>
<tr><td>Essay</td><td>0</td><td>Seminar essay</td><td>0.5</td><td>(Other)</td><td></td></tr>
<tr><td>Tests</td><td>0</td><td>Oral exam</td><td>0</td><td>(Other)</td><td></td></tr>
<tr><td>Written exam</td><td>4.0</td><td>Project</td><td>0</td><td>(Other)</td><td></td></tr>
<tr><td>Grading and evaluating student work in class and at the final exam</td><td colspan="6">Students can take two partial tests during the lectures. If not pass partial tests, students will be evaluated by written exam. Rating at partial tests and the final examination is formed as follows: 51-60% sufficient (2); 61-75% good (3); 76-88% very good (4); 89-100% excellent (5). The total score is formed by summing all activities (for each activity % success multiply weigh coefficient): 5% x the presence and activity in lectures and seminars + 10% x success in experimental work + 43% x performance on the first test + 42% x performance on the second test.</td></tr>
<tr><td>Required literature (available in the</td><td colspan="3">**Title**</td><td colspan="2">**Number of copies in**</td><td>**Availability via other media**</td></tr>
</table>

library and via other media)		**the library**	
	K. H. Basser, G. Buchbauer, Handbook of Essential Oils: Science, Technology and Application, CRC Press, 2010	1	no
	E. Guenther, The Essential Oils, vol. I: History – Origin in Plants – Production – Analysis, Jepson Press, 2008	1	no
	Igor Jerković, Predlošci za predavanja iz Kemije i tehnologije aromatičnog bilja, KTF, 2014.	0	yes (web page KTF)
Optional literature (at the time of submission of study programme proposal)	R. P. Adams, Identification of essential oils by gas chromatography/mass spectrometry, Allured Publishing Corporation, 2007 E. Guenther, The Essential Oils, vol. II-VI, van Nostrand Co, Princeton, 1964.		
Quality assurance methods that ensure the acquisition of exit competences	Monitoring of quality assurance will be performed at three levels: (1) University; (2) Faculty Level by Quality Control Committee; (3) Academic Level.		
Other (as the proposer wishes to add)			

Chemical Ecology

<table>
<tr><td colspan="2">NAME OF THE COURSE</td><td colspan="6">Chemical Ecology</td></tr>
<tr><td>Code</td><td>KTI206</td><td>Year of study</td><td colspan="5">2nd</td></tr>
<tr><td>Course teacher</td><td>PhD, Marija Bralić, associate prof.</td><td>Credits (ECTS)</td><td colspan="5">6.0</td></tr>
<tr><td rowspan="2">Associate teachers</td><td rowspan="2">PhD, Maša Buljac, assistant prof.</td><td rowspan="2">Type of instruction (number of hours)</td><td>L</td><td>S</td><td>E</td><td>F</td></tr>
<tr><td>30</td><td>15</td><td>30</td><td></td></tr>
<tr><td>Status of the course</td><td>Optional</td><td>Percentage of application of e-learning</td><td colspan="5"></td></tr>
<tr><td colspan="7">COURSE DESCRIPTION</td></tr>
<tr><td>Course objectives</td><td colspan="6">Understanding of the basic groups of toxic pollutants, their way of dospjevanja into the environment, the transmission of the environment, their deposit and adversely affected.
Risk assessment and the ability to prevent harmful effects during working with chemicals.</td></tr>
<tr><td>Course enrolment requirements and entry competences required for the course</td><td colspan="6"></td></tr>
<tr><td>Learning outcomes expected at the level of the course (4 to 10 learning outcomes)</td><td colspan="6">After course students will be able to :
1. definition of basic concepts and history of chemical ecology
2. the origin of the chemical constituents in the ecosystem
3. classification and labelling of hazardous chemicals
4. transport mechanisms in the environment
5. sources of pollution as a result of human activity
6. interactive impact of pollutants
7. how to process the obtained knowledge of the toxicological and ecotoxicological information</td></tr>
<tr><td>Course content broken down in detail by weekly class schedule (syllabus)</td><td colspan="6">Lecture 1: Introduction. Definition of basic concepts in ecology
Lecture 2: Identification of chemical components in the ecosystems, natural resources.
Lecture 3: Risk assessment of pollutants
Lecture 4: The main disturbances in ecosystems caused by human activities
Lecture 5: Overview of the sources of pollution as a result of human activity
Lecture 6:Distribution of pollutants. Pesticides, metals, fertilizers, mechanisms of toxicity
Lecture 7: The first midterm test
Lecture 8: Physical and chemical properties
Lecture 9:.The transport mechanisms in soil, water and air
Lecture 10: Bioaccumulation and bioconcentration in organisms and ecosystems
Lecture 11:The excretion of toxic substances from the organism
Lecture 12:Mitigation of biodegradation
Lecture 13: Sources and effects of contamination. Determination of risk from an environmental point of view
Lecture 14: The classification and labeling of hazardous chemicals. Legislation and toxicological tests in Croatia and the EU.
Lecture 15: The second midterm test
Seminar: The seminar consists of practical tasks and student seminars.</td></tr>
</table>

<table>
<tr><td></td><td colspan="6">Determining the kind of interaction of different pollutants in a particular case. To determine the classification of adverse effects. Defining the concentration limit harmful substances.
Students independently produced work on a selected topic on the basis of scientific papers in the relevant scientific databases and presenting it.
Lab course: Methods of preparation materials. Qualitative and quantitative analysis of the most important pollutants. Ecotoxicity tests. Determination of metal toxicity biomonitoring. Determination of the harmfulness of fluoride ion in the environmental community in an aqueous medium. Analysis of the results obtained toxicity tests, statistical methods.</td></tr>
<tr><td>Format of instruction</td><td colspan="3">×lectures
×seminars and workshops
×exercises
☐bn linein entirety
☐partial e-learning
☐field work</td><td colspan="3">☐ndependent assignments
☐multimedia
×laboratory
☐work with mentor
☐ (other)</td></tr>
<tr><td>Studentresponsibilities</td><td colspan="6"></td></tr>
<tr><td rowspan="6">Screening student work(name the proportion of ECTS credits for eachactivity so that the total number of ECTS credits is equal to the ECTS value of the course)</td><td>Class attendance</td><td>1.0</td><td>Research</td><td></td><td>Practical training</td><td></td></tr>
<tr><td>Experimental work</td><td>1.0</td><td>Report</td><td></td><td>(Other)</td><td>0.5</td></tr>
<tr><td>Essay</td><td></td><td>Seminar essay</td><td></td><td>(Other)</td><td></td></tr>
<tr><td>Tests</td><td>1.0</td><td>Oral exam</td><td>1.5</td><td>(Other)</td><td></td></tr>
<tr><td>Written exam</td><td>1.0</td><td>Project</td><td></td><td>(Other)</td><td></td></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Grading and evaluating student work in class and at the final exam</td><td colspan="6">During the semester, the two partial test to check if the knowledge of students from courses included material. During the semester students will be selected from the lecture topic to make a seminar that will affect the final grade. After completion of the semester, students take a written exam courses included material from the seminar. If the student meets at one of the partial tests during the semester, material from passing the test does not need to take the written exam. After passing the written part of the exam, the oral exam. Prior to joining the laboratory exercises, students' knowledge of material from the respective exercise will be verified by tests. All exercises must be passed all preliminary exams and completed. The student has the right to exercise fail one exercise, but you will catch up at the end of the semester. For all aspects of teaching evaluation will be conducted according to the following criteria: <55% inadequate; 55% -65% is sufficient; 66% -75% good; 76% -85% very good;> 86% excellent. The final grade will be the arithmetic average of ratings from exercises, written assessment and oral examination.</td></tr>
<tr><td rowspan="3">Required literature (available in the library and 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">C.H.Walker,S.P.Hopkin, R.M. Sibly, D.B. Peakall. Principles of Ekotoxicology, Taylor&Francis,London, 2006.</td><td></td><td>1

1</td></tr>
<tr><td colspan="3">B.L. Carson, H.V.Ellis III, J.L.McCann. Toxicology and biological monitoring of metals in humans,</td><td></td><td></td></tr>
</table>

	Lewis Publishers, INC.Michigan, 1987..		
	F. Plavšić, I. Žuntar. Uvod u analitičku toksikologiju, Školska knjiga Zagreb, Zagreb, 2006.		1
Optional literature (at the time of submission of study programme proposal)	V.Srebočan. Veterinarska toksikologija, Medicinska naklada, Zagreb, 2009. L. Robinson, I. Thorn. Toxicology and Ecotoxicology in chemical safety assessment, Blackwell Publishing Ltd., 2005.		
Quality assurance methods that ensure the acquisition of exit competences	Methods Quality assurance will be performed at three levels: (1) University; (2) Faculty Level by Quality Control Committee of teaching; (3) Level.		
Other (as the proposer wishes to add)			

Physical methods of analysis

NAME OF THE COURSE	Physical methods of analysis					
Code	KTH102	Year of study	1			
Course teacher	PhD. Josipa Giljanović, associat prof.	Credits (ECTS)	6			
Associate teachers		Type of instruction (number of hours)	L	S	E	F
			30	15	30	0
Status of the course	Elective	Percentage of application of e-learning				
COURSE DESCRIPTION						
Course objectives	Acquisition of basic knowledge about the physical methods of analysis based on optical and electrochemical phenomena. To enable students to understand and apply the acquired knowledge in practice in the analysis of complex samples					
Course enrolment requirements and entry competences required for the course	Completed appropriate undergraduate study					
Learning outcomes expected at the level of the course (4 to 10 learning outcomes)	1. Adoption of the basic knowledge and principles of the application of spectroscopic techniques for analysis of complex samples 2. Understand and apply the methods of sample preparation for chemical analysis 3. Apply spectroscopic analysis methods in the analysis of complex samples. 4. Implement separation analysis methods in the analysis of complex samples. 5. Apply the principles of validation of the analytical method					
Course content broken down in detail by weekly class schedule (syllabus)	1. week: Analytical system. Sampling from the environment. Seminar: Solving problems. 2. Week: Preparation of the sample for analysis. Seminar: Solving problems. 3. week: Method of isolation of the analyte from the nuts: solid phase extraction, microwave ultrasonic extraction. Seminar: Solving problems. 4. Week: Spectroscopic methods. Molecular Spectroscopy. Seminar: Solving problems. 5. Week: Atomic absorption spectroscopy, mass spectroscopy. Seminar: Solving problems. 6. week: Chromatographic methods: gas, ion, thin layer chromatography. Seminar: Solving problems. 7. Week : 1st. partial exam, solving the test 8. week: High performance liquid chromatography. Seminar: Solving problems. 9. week: Validation of methods. Comparison of methods. The choice of the appropriate method. Seminar: Solving problems 10. Week: Statistical analysis and evaluation of results, and obtain information about the sample. Seminar: Solving problems					

<table>
<tr><td></td><td colspan="6">11. Week: Validation of spectoscopic methods, examples. Seminar: Solving problems

12.Validation of chromatographic methods examples. Seminar: Solving problems

13 Week: Automation in the analytical laboratory. Segmented flow method. Seminar: Solving problems

14. Week: flow-injection method. An automated analytical systems. Seminar: Solving problems

15. Week : 2 nd partial exam , solving the test</td></tr>
<tr><td>Format of instruction</td><td colspan="3">☒ lectures
☒ seminars and workshops
☒ exercises
□on linein entirety
□partial e-learning
□field work</td><td colspan="3">□independent assignments
☒ multimedia
☒ laboratory
□work with mentor
□ (other)</td></tr>
<tr><td>Studentresponsibilities</td><td colspan="6">Lectures attendance - at least 80% and completing exercises</td></tr>
<tr><td rowspan="6">Screening student work(name the proportion of ECTS credits for eachactivity so that the total number of ECTS credits is equal to the ECTS value of the course)</td><td>Class attendance</td><td>0,5</td><td>Research</td><td></td><td>Practical training</td><td></td></tr>
<tr><td>Experimental work</td><td></td><td>Report</td><td></td><td>Laboratory Exercises</td><td>2,5</td></tr>
<tr><td>Essay</td><td></td><td>Seminar essay</td><td>1,5</td><td>(Other)</td><td></td></tr>
<tr><td>Tests</td><td></td><td>Oral exam</td><td>1</td><td>(Other)</td><td></td></tr>
<tr><td>Written exam</td><td>1</td><td>Project</td><td>1</td><td>(Other)</td><td></td></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Grading and evaluating student work in class and at the final exam</td><td colspan="6">The entire test can be applied over two partial tests during the semester. Passing threshold is 60%. Each test in assessing participates with 50%. Lectures presence of 80 to 100% is 10% marks. The examination periods there is a written and oral exam. Passing threshold is 60%. Passing one partial test of any part (previous activity) is valid throughout current academic year. Written exam has a share of 50% and oral examination also 50%. Students who have not passed the partial tests will have oral examination in the regular examination period. Passing threshold is 60% and the examination form to participate in the evaluation by 50%.

Rating: 60% -69% - satisfactory, 70% -79% - good, 80% -89% very good, 90% - 100% - excellent.</td></tr>
<tr><td rowspan="5">Required literature (available in the library and 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">1. D. A.Skoog, D. M. West, F. J. Holler, Fundamentals of Analytical Chemistry, Seventh Edition, Saunders College Publishing, New York, London, 1996. { šesto izdanje (englesko) 1992, prvo izdanje (hrvatsko), Školska knjiga, Zagreb, 1999.};
2.A. Skoog, D. M. West i F. J. Holler, S. R. Crouch, Fundamentals of Analytical Chemistry, 9th edition,</td><td>1. 6</td><td>Web page of the Department of Analytical Chemistry</td></tr>
<tr><td colspan="3"></td><td></td><td></td></tr>
<tr><td colspan="3"></td><td></td><td></td></tr>
<tr><td colspan="3"></td><td></td><td></td></tr>
</table>

	Brooks&Cole, SAD, 2014.; 3.D.C.Harris, Quantitative Chemical Analysis, Eighth Edition, W.H.Freeman and Company, New York, 2010.		
Optional literature (at the time of submission of study programme proposal)			
Quality assurance methods that ensure the acquisition of exit competences	• registration of student's presence in class • annual analysis of students success in this course • student's survey in order to evaluate the professor • professor's self-evaluation		
List of laboratory excersise	1. Determination of amount ash in flour 2. Determination of phosphorus in ash flour 3. Determination of pKa acid-base indicators 4. Determination of composition of the complex compound iron (III) sulfosalicylic acid		
Other (as the proposer wishes to add)			

Solid State Physics

COURSE NAME	Solid State Physics					
Course code	KTI208	Year of study	2nd			
Course lecturer	PhD, Magdi Lučić Lavčević, associate prof.	Credits (ECTS)	6.0			
Assistants		Type of instruction	P	S	V	T
			30	15	30	0
Course status	Elective	Application of e-learning (percentage)				
COURSE DESCRIPTION						
Course objectives	Analysis of the structure and properties of solids by theoretical and experimental methods, with emphasis on the substances with crystal structure.					
Course enrolment requirements and entry competences required for the course	none					
Learning outcomes expected at the level of the course (4 to 10 learning outcomes)	After the course students should: - Know the characteristics of the structure and properties of crystalline and amorphous solids; - Master the structural characterization of solids, using the reciprocal space; - Be able to determine the parameters of elasticity and plasticity of solids using appropriate methods; - Use quantum approach when analyzing the properties of crystals; - Know and understand in detail the properties of metals, semiconductors and dielectrics; - Understand the mechanisms of selected phenomena in solids; - Know the possibilities of applying the properties of solids; - Be able to analyze the relationship between the properties and the dimensionality of solids.					
Course content broken down in detail by weekly class schedule (syllabus)	U zagradama je naznačen broj sati predavanja i seminara (P+S). Structural properties of solid bodies. Structure of crystals. (4+2) Diffraction of waves and reciprocal lattice.(2+2) Experimental diffraction methods.(2+2) Difusion in solid bodies.(3+1) Elastic and plastic properties of solid bodies. (1+2) Fundamentals of quantum mechanics.(1) Energy levels of electrons in solid bodies.(2+1) Static and transport properties of electrons in metals. (3+1) Vibrations waves in crystals – phonons.(2+1) Thermal properties.(2+1) Semiconductors.(2+1) Optical properties of dielectrics and semiconductors.(1+1) Fundamental phenomena and devices.(1) Microstructures and nanostructures.(2) Magnetism.(2) Number of hours of lectures and seminars (L + S) are indicated in brackets. Laboratory exercices: diodes and semiconductor diodes (4), photoelectric effect (4), thermoelectric effect (4), the Hall effect (4), data analysis of structural characterization (4), data analysis of morphological characterization (4) data analysis of moduli of elasticity and hardness (2) lasers and semiconductor lasers (4)					
Format of instruction	**x** lectures ☐ seminars and workshops **x** exercises ☐ *on line* in entirety ☐ partial e-learning		☐ independent assignments **x** multimedia **x l**aboratory ☐ **work with mentor** **x** group and individual tutorials			

<table>
<tr><td></td><td colspan="3">☐ field work</td><td colspan="3">x seminars</td></tr>
<tr><td>Student responsibilities</td><td colspan="6"></td></tr>
<tr><td rowspan="6">Screening student work (name the proportion of ECTS credits for each activity so that the total number of ECTS credits is equal to the ECTS value of the course)</td><td>Class attendance</td><td>1.0</td><td>Research</td><td></td><td>Practical training</td><td></td></tr>
<tr><td>Experimental work</td><td>1.0</td><td>Report</td><td></td><td>Pre-test preparation classes</td><td>0.5</td></tr>
<tr><td>Essay</td><td></td><td>Seminar essay</td><td>0.5</td><td>(Other)</td><td></td></tr>
<tr><td>Tests</td><td>1.5</td><td>Oral exam</td><td>1.5</td><td>(Other)</td><td></td></tr>
<tr><td>Written exam</td><td></td><td>Project</td><td></td><td>(Other)</td><td></td></tr>
<tr><td colspan="6"></td></tr>
<tr><td>Grading and evaluating student work in class and at the final exam</td><td colspan="6">During the semester, the final exam can be substituted by midterm tests and seminar essays (independent computational tasks).
In the final exam perods the final exam shall be taken after the presentation of seminar essays.
Grades: 55-64% - sufficient; 65-79% - good, 80-89% - very good; 90-100% - excellent.</td></tr>
<tr><td rowspan="5">Required literature (available in the library and via other media)</td><td colspan="3">Book title</td><td>Number of books in the library</td><td colspan="2">Available via other media</td></tr>
<tr><td colspan="3">M. Lučić Lavčević, Solid state physics , 2007. internal script</td><td></td><td colspan="2">Personal web-site</td></tr>
<tr><td colspan="3">V. Šips: Uvod u fiziku čvrstog stanja, Školska knjiga Zagreb, Zagreb, 1993</td><td>1</td><td colspan="2">-</td></tr>
<tr><td colspan="3">v. Knapp, P. Colić: Uvod u električna i magnetska svojstva materije, Školska knjiga Zagreb, Zagreb, 1990;</td><td>1</td><td colspan="2"></td></tr>
<tr><td colspan="3">C. Kittel: Introduction to solid state physics, John Wiley&Sons, New York, 2005</td><td>1</td><td colspan="2"></td></tr>
<tr><td>Quality assurance methods that ensure the acquisition of exit competences</td><td colspan="6">Quality of the teaching and learning, monitored at the level of the
(1) teachers, accepting suggestions of students and colleagues, and
(2) faculty, conducting surveys of students on teaching quality.</td></tr>
<tr><td>Other (as the proposer wishes to add)</td><td colspan="6"></td></tr>
</table>

Corrosion and Materials Protection

NAME OF THE COURSE	Corrosion and Materials Protection					
Code	KTI209	Year of study	2nd			
Course teacher	PhD, Maja Kliškić, prof.	Credits (ECTS)	5.0			
Associate teachers		Type of instruction (number of hours)	L	S	E	F
			30		30	
Status of the course	Elective	Percentage of application of e-learning	-			

COURSE DESCRIPTION	
Course objectives	The objective of this course is to achieve a knowledge about fundamentals of corrosion processes and corrosion protection, and methods of corrosion testing and prevention. This course will provide student to acquire an orderly pattern of thought in solving practical corrosion problems in a critical and creative manner.
Course enrolment requirements and entry competences required for the course	
Learning outcomes expected at the level of the course (4 to 10 learning outcomes)	By the end of this course, students will be able to: - define and classify the corrosion processes - evaluate the resistance of materials for any given conditions - perform the corrosion tests - ascertain and select the most effective corrosion protection system for any given conditions – project related and on-site if appropriate – and evaluate its durability
Course content broken down in detail by weekly class schedule (syllabus)	1st week: Definition and importance of corrosion. Classification of corrosion processes. 2nd week: Chemical corrosion. thermodynamic conditions. The mechanism and kinetics of chemical corrosion process. Resistance to chemical corrosion. 3rd week: Electrochemical corrosion. Thermodynamic conditions. The mechanism and kinetics of electrochemical corrosion process. Types of electrochemical corrosion. 4th week: Corrosion of inorganic materials (corrosion of concrete, reinforcement in concrete, ceramics and glass in aggressive environments). 5th week: Corrosion under specific conditions: in the atmosphere, water, sea water. 6th week: Corrosion in soil, in melts. 7th week: Corrosion caused by microorganisms. 8th week: First test 9th week: Corrosion protection by materials selection and proper designing. 10th week: Materials protection using corrosion inhibitors. 11th week: Electrochemical methods of protection. 12th week: Surface protection. Selection of coatings and paints. 13th week: The importance of inspection and maintenance. 14th week: Corrosion tests. Standards. 15th week:. Second test. Exercises: Monitor atmospheric corrosion. Examination of corrosion rate by polarization methods. Determination of the critical pitting temperature of stainless steel.

<table>
<tr><td></td><td colspan="6">Examination of corroded metal samples by optical microscopy. Protection of aluminum alloy anodizing and processing of the oxide film. Determination of the effectiveness of organic corrosion inhibitors. Cathodic protection by means of a protector.</td></tr>
<tr><td>Format of instruction</td><td colspan="3">x lectures
☐ seminars and workshops
x exercises
☐ on linein entirety
☐ partial e-learning
☐ field work</td><td colspan="3">☐ independent assignments
X multimedia
☐ laboratory
☐ work with mentor
☐(other)</td></tr>
<tr><td>Student responsibilities</td><td colspan="6">Lecture attendance: 80 %. Exercises attendance: 100 %.</td></tr>
<tr><td rowspan="6">Screening student work(name the proportion of ECTS credits for eachactivity so that the total number of ECTS credits is equal to the ECTS value of the course)</td><td>Class attendance</td><td>1.5</td><td>Research</td><td></td><td>Practical training</td><td>1.0</td></tr>
<tr><td>Experimental work</td><td></td><td>Report</td><td></td><td>(Other)</td><td></td></tr>
<tr><td>Essay</td><td></td><td>Seminar essay</td><td></td><td>(Other)</td><td></td></tr>
<tr><td>Tests</td><td>2.5</td><td>Oral exam</td><td></td><td>(Other)</td><td></td></tr>
<tr><td>Written exam</td><td></td><td>Project</td><td></td><td>(Other)</td><td></td></tr>
<tr><td></td><td colspan="5"></td></tr>
<tr><td>Grading and evaluating student work in class and at the final exam</td><td colspan="6">The entire course can be passed by two partial exams during the semester. Passing threshold is 60%. Each partial exam in assessing participates with 40% and exercises with 20%. On examination shedule students will have oral exam. Scoring: <60% insufficient, 61 - 69% - sufficient (2), 70 - 79% - good (3), 80-89% very good (4), 90 - 100% - excellent (5).</td></tr>
<tr><td rowspan="10">Required literature (available in the library and 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">J.R. Davis, Corrosion – understanding the basic, ASM International, 2000.</td><td>1</td><td colspan="2"></td></tr>
<tr><td colspan="3">B. Jarić, A. Rešetić, Korozija i katodna zaštita, Korexpres, Zagreb, 2003.</td><td>1</td><td colspan="2"></td></tr>
<tr><td colspan="3">I. Esih, Osnove površinske zaštite, Fakultet strojarstva i brodogradnje Sveučilišta u Zagrebu, Zagreb, 2003.</td><td>1</td><td colspan="2"></td></tr>
<tr><td colspan="3"></td><td></td><td colspan="2"></td></tr>
<tr><td colspan="3"></td><td></td><td colspan="2"></td></tr>
<tr><td colspan="3"></td><td></td><td colspan="2"></td></tr>
<tr><td colspan="3"></td><td></td><td colspan="2"></td></tr>
<tr><td colspan="3"></td><td></td><td colspan="2"></td></tr>
<tr><td>Optional literature (at the time of submission of study programme proposal)</td><td colspan="6">R. Babolan, Corrosion Tests and Standards, Amer. Tech. Pulbl. Ltd. New York, 1995.
P. Marcus, J. Oudar (Eds.), Corrosion Mechanisms in Theory and Practice, M. Dekker, New York, 1995.</td></tr>
<tr><td>Quality assurance methods that ensure the acquisition of exit</td><td colspan="6">- Tracking suggestions and reactions of participants during the semester
- Student survey</td></tr>
</table>

competences	
Other (as the proposer wishes to add)	

Mathematical Tools in Chemical Engineering

NAME OF THE COURSE	Mathematical Tools in Chemical Engineering					
Code	KTI210	Year of study	2nd			
Course teacher	PhD, Davor Rušić, prof.	Credits (ECTS)	4.0			
Associate teachers		Type of instruction (number of hours)	L	S	E	F
			30	0	15	0
Status of the course	Optional	Percentage of application of e-learning				

COURSE DESCRIPTION	
Course objectives	To familiarize students with the mathematical tools and their meaning in chemistry and chemical engineering.
Course enrolment requirements and entry competences required for the course	
Learning outcomes expected at the level of the course (4 to 10 learning outcomes)	To analyze the problem, conduct calculations, to conclude the possibilities of a mathematics software program used.
Course content broken down in detail by weekly class schedule (syllabus)	Week 1: Convert text from Word into MathCad and editing text in this tool. Week 2: Introduction to mathematical tools and application of text from MathCad Week 3: Data input and graphical display Week 4: 2D graphics Week 5: 3D Graphics Week 7: Mathematical functions and zero point Week 8: First colloquium Week 9: The intersection of the curve Week 10: Derivatives and integrals Week 11: Matrix algebra Week 12: Equations Week 13: The flow function Week 14: A correlational-regression analysis Week 15: Second colloquium *Exercises:* Week 1: Convert text from Word into MathCad and editing text in this tool. Week 2: Introduction to mathematical tools and application of text from MathCad Week 3: Data input and graphical display Week 4: 2D graphics Week 5: 3D Graphics Week 7: Mathematical functions and zero point Week 8: First colloquium Week 9: The intersection of the curve Week 10: Derivatives and integrals Week 11: Matrix algebra Week 12: Equations Week 13: The flow function Week 14: A correlational-regression analysis

	Week 15: Second colloquium	
Format of instruction	☒lectures ☐seminars and workshops xexercises ☐*on line* in entirety ☐partial e-learning ☐field work	☐independent assignments ☐multimedia ☐laboratory ☐work with mentor ☐ (other)
Student responsibilities	**Student responsibilities:** Regular attendance and active participation at lectures, seminars and exercises	

Screening student work*(name the proportion of ECTS credits for eachactivity so that the total number of ECTS credits is equal to the ECTS value of the course)*						
	Class attendance	2.0	Research		Practical training	
	Experimental work	1.0	Report		(Other)	
	Essay		Seminar essay		(Other)	
	Tests		Oral exam		(Other)	
	Written exam	1.0	Project		(Other)	

Grading and evaluating student work in class and at the final exam	**Grading and evaluating student work in class and at the final exam** A student can pass a part or the entire exam by taking two partial tests during the semester. Students who do not pass the partial exams have to take an exam in the regular examination term. During the examination terms students take written and oral exam. Scoring: <55% insufficient;55-66% sufficient (2); 67-79% good (3); 80-92% very good (4); 93-100% excellent (5)

Required literature (available in the library and via other media)	**Title**	**Number of copies in the library**	**Availability via other media**
	D.Rušić, E. Bacci, MATEMATIČKI ALATI		

Optional literature (at the time of submission of study programme proposal)	
Quality assurance methods that ensure the acquisition of exit competences	**Quality assurance methods that ensure the acquisition of exit competences:** Quality of the teaching and learning, monitored at the level of the (1) teachers, accepting suggestions of students and colleagues, and (2) faculty, conducting surveys of students on teaching quality.
Other (as the proposer wishes to add)	

Energy and Development

COURSE NAME	Energy and Development					
Course code	KTC217	Year of study	2nd			
Course lecturer	PhD, Mirko Marušić, lecturer	Credits (ECTS)	2.0			
Assistants		Type of instruction	L	S	E	F
			30	0	0	0
Course status	Elective	Application of e-learning (percentage)				
COURSE DESCRIPTION						
Course objectives	Obtaining basic theoretical knowledge in the field of energetics. Introduction to basic information needed for active participation in classes in the field of termotechnics and energetics.					
Course enrolment requirements and entry competences required for the course	none					
Learning outcomes expected at the level of the course (4 to 10 learning outcomes)	- Describing the ways of energy conversion and comparing conventional energy sources. - Describing the ways in which electricity can be produced. - Describing the ways in which nuclear energy can be used and analyizing the operation of a nuclear power plant. - Defining and describing the types of renewable energy sources. - Describing the basic characteristics of water energy usage. - Describing the ways in energy of the sun can be used and its basic characteristics. - Describing the basic characteristics of the usage of wind energy. - Describing the ways in which geotermal energy and biomass energy can be used, as well as their basic characteristics. - Defining and describing the basic elements of energetic planning and energetic policy.					
Course content broken down in detail by weekly class schedule (syllabus)	- 1st week: Energy: definition and units, energy inflow the on Earth, Earth's energy balance - energy crises, enegy resources, energy supplays, energy conversion and heat. - 2nd week: Consumption of energy; historical development, regional consumption, influence on the life quality, consumption and saving of energy in basic sectors (industry, traffic, households), estimation of global energetics development. - 3rd week: Energy of fossil fuels: coal. - 4th week: Energy of fossil fuels: oil. - 5th week: Energy of fossil fuels: natural gas. Partial assessment (1st preliminary test) - 6th week: Thermal power plant, influence on environmente (greenhouse effects, acid rains, particulates, heat contamination), exploitation of waste heat, magnetohydrodynamic generators. - 7th week: Hydroenergy: basic characteristics of water flow, hydro-electric power plants.					

<table>
<tr><td></td><td colspan="6">- 8th week: Nuclear energy: fission.
- 9th week: Nuclear reactors.
- 10th week: Nuclear fuels. Partial assessment (2nd preliminary test)
- 11th week: Nuclear fusion, projects of fusion devices.
- 12th week: Influence of nuclear energy on mankind and environmente.
- 13th week: Solar energy: conversion in heat energy (active and passive solar systems, solar furnaces, solar-electric power plants), photovoltaic conversion (photovoltaicells and photovoltaic systems), application of nanotechnology, bioconversion (cultivation and energetical exploitation of biomass).
- 14th week: Wind energy: basic characteristics, wind turbines, wind-electric power plants.
- 15th week: Energy of oceans and seas: energy of high and low tide, energy of waves, heat energy. Geothermal energy: hydrogeothermal and petrogeothermal energy supplays, influence on environmente. Storage of energy. Partial assessment (3nd preliminary test).</td></tr>
<tr><td>Format of instruction</td><td colspan="3">X lectures
☐ seminars and workshops
☐ exercises
☐ on line in entirety
☐ partial e-learning
X field work</td><td colspan="3">☐ independent assignments
X multimedia
☐ laboratory
☐ work with mentor
X group and individual tutorials
☐ seminars</td></tr>
<tr><td>Student responsibilities</td><td colspan="6"></td></tr>
<tr><td rowspan="5">Screening student work (name the proportion of ECTS credits for each activity so that the total number of ECTS credits is equal to the ECTS value of the course)</td><td>Class attendance</td><td>0.5</td><td>Research</td><td></td><td>Practical training</td><td></td></tr>
<tr><td>Experimental work</td><td></td><td>Report</td><td></td><td>Pre-test preparation classes</td><td></td></tr>
<tr><td>Essay</td><td></td><td>Seminar essay</td><td></td><td>(Other)</td><td></td></tr>
<tr><td>Tests</td><td>0.5</td><td>Oral exam</td><td>0.5</td><td>(Other)</td><td></td></tr>
<tr><td>Written exam</td><td>0.5</td><td>Project</td><td></td><td>(Other)</td><td></td></tr>
<tr><td>Grading and evaluating student work in class and at the final exam</td><td colspan="6">In course of the semester, the entire exam can be passes by taking and passing the three preliminary tests consisting of theoretical questions.
In the examination periods oral exam is taken.
Grades: 55-64% - sufficient; 65-79% - good, 80-89% - very good; 90-100% - excellent.</td></tr>
<tr><td rowspan="4">Required literature (available in the library and via other media)</td><td colspan="3">Book title</td><td>Number of books in the library</td><td colspan="2">Available via other media</td></tr>
<tr><td colspan="3">Internal script</td><td></td><td colspan="2">Web portal</td></tr>
<tr><td colspan="3"></td><td></td><td colspan="2">-</td></tr>
<tr><td colspan="3"></td><td></td><td colspan="2">-</td></tr>
<tr><td>Optional literature</td><td colspan="6">D. Krpan-Lisica, Osnove energetike, Hinus, Zagreb, 2001.
C.J. Cleveland, Editor, Encyclopedia of Energy, Vol.1-6, Elsevier, San Diego 2004.
H. Požar, Osnove energetike 1,2, Školska knjiga, Zagreb, 1992.
V. Knapp, Novi izvori energije 1, Školska knjiga, Zagareb, 1993.
P. Kulišić, Novi izvori energije 2, Školska knjiga, Zagreb, 1991.</td></tr>
<tr><td>Quality assurance methods that</td><td colspan="6">Quality assurance will be performed at three levels:</td></tr>
</table>

ensure the acquisition of exit competences	(1) University Level; (2) Faculty Level by Quality Control Committee; (3) Lecturer's Level.
Other (as the proposer wishes to add)	

Colloid Chemistry

<table>
<tr><td colspan="2">NAME OF THE COURSE</td><td colspan="6">Colloid Chemistry</td></tr>
<tr><td>Code</td><td>KTH214</td><td>Year of study</td><td colspan="5">2nd</td></tr>
<tr><td>Course teacher</td><td>PhD, Vesna Sokol, assistant prof.</td><td>Credits (ECTS)</td><td colspan="5">6.0</td></tr>
<tr><td rowspan="2">Associate teachers</td><td rowspan="2"></td><td rowspan="2">Type of instruction (number of hours)</td><td>L</td><td>S</td><td>E</td><td>F</td></tr>
<tr><td>30</td><td>15</td><td>30</td><td></td></tr>
<tr><td>Status of the course</td><td>Elective</td><td>Percentage of application of e-learning</td><td colspan="5"></td></tr>
<tr><td colspan="7">COURSE DESCRIPTION</td></tr>
<tr><td>Course objectives</td><td colspan="6">Students will expand basic knowledge of colloid chemistry obtained from lectures in Physical Chemistry. They will learn principles and applications of surface and colloid chemistry.</td></tr>
<tr><td>Course enrolment requirements and entry competences required for the course</td><td colspan="6"></td></tr>
<tr><td>Learning outcomes expected at the level of the course (4 to 10 learning outcomes)</td><td colspan="6">Students will upon completion of the course
1) know the modern instrument methods of separation, purification and identification of colloids, 2) be able to interpret properties and effects of surfactants (micellar colloids), 3) be able to explain the kinetic phenomena of colloidal solutions, 4) understand the electrokinetic phenomena, 5) be able to explain the rheological properties of colloidal system.</td></tr>
<tr><td>Course content broken down in detail by weekly class schedule (syllabus)</td><td colspan="6"><u>Lectures</u>
1st week: Introduction. Classification of colloidal systems. Aggregation of colloidal particles.
2nd week: Micelle formation. Properties and structure of micelles in aqueous and non-aqueous solutions.
3rd week: Purification and separation of colloids, ultrafiltration, reverse osmosis.
4th week: Dialysis, lyophilization, gel filtration.
5th week: Size and shape of colloidal particles. Experimental techniques for determining the size and shape of the colloidal particles.
6th week: Kinetic properties of the colloidal systems, sedimentation, diffusion, osmotic pressure.
7th week: Interface Phenomena: liquid-gas, liquid-liquid, solid-liquid interface.
8th week: Viscosity of colloidal systems.
9th week: Experimental techniques for determining the surface composition.
10th week: Rheology of colloidal systems.
11th week: Electrical double layer, electrophoresis.
12th week: Electrokinetic potential and electrical mobility, electrokinetic phenomena.
13th week: Coagulation and stability of colloids.
14th week: Gel, membrane, biological membrane.
15th week: Emulsions and microemulsions.

<u>Laboratory exercises</u>
1. Microemulsions, size of microemulsions aggregates and dynamic. 2. Surface tension. 3. Critical micelle concentration. 4. Standard Gibbs energies of micellization of surfactants in aqueous solutions at different electrolyte concentrations. 5.</td></tr>
</table>

	Microstucture and stability in surfactant free microemulsions.

Format of instruction	2. xlectures 3. xseminars and workshops 4. xexercises 5. ☐*on line*in entirety 6. ☐partial e-learning ☐field work	7. xindependent assignments 8. xmultimedia 9. xlaboratory 10. ☐work with mentor ☐ (other)
Studentresponsibilities	Students are required to attend classes and actively participate in the teaching process. This will be recorded and evaluated in making a final assessment.	

Screening student work*(name the proportion of ECTS credits for eachactivity so that the total number of ECTS credits is equal to the ECTS value of the course)*						
	Class attendance	1.5	Research		Practical training	
	Experimental work	1.0	Report		(Other)	
	Essay		Seminar essay	0.5	(Other)	
	Tests	1.0	Oral exam	1.0	(Other)	
	Written exam	1.0	Project		(Other)	

Grading and evaluating student work in class and at the final exam	The course content is divided into two units that students take over partial exams or joining final exam at the end of the semester. The exam is considered passed if students achieve at least 60%. The final grade is based on the evaluation of partial exams. Grades: <60% not satisfied; 60-69% successful (2) 70-79% good (3), 80-89% very good (4), 90-100% excellent (5).

Required literature (available in the library and via other media)	**Title**	**Number of copies in the library**	**Availability via other media**
	K. S. Birdi, Surface and Colloid Chemistry, Principles and Applications, CRC Press, Boca Raton, London; New York, 2010.	1	
	P. C. Hiemenz, R. Rajagopalan, Principles of Colloid and Surface Chemistry, 3rd Edition, Marcel Dekker, New York, 1997.	1	

Optional literature (at the time of submission of study programme proposal)	Duncan J. Shaw, Introduction to Colloid and Surface Chemistry, 4th Edition, Butterrorth-Heinemann, Oxford, 1992.
Quality assurance methods that ensure the acquisition of exit competences	Quality of the teaching and learning, monitored at the level of the (1) teachers, accepting suggestions of students and colleagues, and (2) faculty, conducting surveys of students on teaching quality.
Other (as the	

proposer wishes to add)	

Methods of separation and speciation

NAME OF THE COURSE	Methods of separation and speciation					
Code	KTI101	Year of study	1			
Course teacher	PhD, Josipa Giljanović, associat prof.	Credits (ECTS)	6,0			
Associate teachers		Type of instruction (number of hours)	L	S	E	F
			30	15	30	0
Status of the course	Elective	Percentage of application of e-learning				
COURSE DESCRIPTION						
Course objectives						
Course enrolment requirements and entry competences required for the course	Completing the course: General Chemistry					
Learning outcomes expected at the level of the course (4 to 10 learning outcomes)	1. Adoption of fundamental knowledge about the species and speciation analysis 2. Understand and apply the methods of sample preparation for analysis of species 3. Implement the instrumental methods in the analysis of complex species sample. 4. Implement the principles of validation of the analytical method in the analysis of species					
Course content broken down in detail by weekly class schedule (syllabus)	1. Week: Analytical system. Sampling processing samples for analysis species. Seminar: Solving numerical examples treated theoretical material. 2. Week: Preparation of the sample for analysis species, validation, measurement uncertainty for sampling Seminar: Solving problems. 3. week: The importance and definition of speciation., Structural areas of speciation, isotopic composition, electronic and oxidation states. Seminar: Solving problems 4. Week: speciation of inorganic and organic compounds and complexes, organometallic compounds, speciation macromolecular compounds. Seminar: Solving problems 5. Week: Methodology specijacijske analysis. Seminar: Solving problems 6. week: Methods and techniques for speciation analysis and application. Seminar: Solving problems 7. Week 1.parcijalni test, solving test 8. week: The standard methods and reference materials, validation. Seminar: Solving problems 9. week: Application spectrometry as a detection system in the analysis of species. Seminar: Solving problems 10. week: Validation of spectroscopic methods and anliza species. Seminar: Solving problems 11. Week: Ion-selective electrode application in the analysis of species. Seminar: Solving problems 12. Week: Analysis of speciation, an example from the environment. Seminar: Solving problems 13 Week. Analysis of speciation, examples of analyzes of food. Seminar: Solving problems 14. Week: flow-injection method, an example of an analysis of species. An					

<table>
<tr><td></td><td colspan="6">automated analytical systems. Seminar: Solving problems
15th week: Examination (II. Partial test theoretical and seminar materials). Solving test
List of exercises:
1. Gravimetric determination of iron species
2. Spectrophotometric determination of iron species
3. Gravimetric determination of chromium species
4. Spectrophotometric determination of chromium species
5. Determination of EDTA species</td></tr>
<tr><td>Format of instruction</td><td colspan="3">☒ lectures
☒ seminars and workshops
☒ exercises
□on linein entirety
□partial e-learning
□field work</td><td colspan="3">□independent assignments
☒ multimedia
☒ laboratory
□work with mentor
□ (other)</td></tr>
<tr><td>Studentresponsibilities</td><td colspan="6">Lectures attendance - at least 80% and completing exercises</td></tr>
<tr><td rowspan="6">Screening student work(name the proportion of ECTS credits for eachactivity so that the total number of ECTS credits is equal to the ECTS value of the course)</td><td>Class attendance</td><td>0,5</td><td>Research</td><td></td><td>Practical training</td><td></td></tr>
<tr><td>Experimental work</td><td></td><td>Report</td><td></td><td>Laboratory Exercises</td><td>1,5</td></tr>
<tr><td>Essay</td><td></td><td>Seminar essay</td><td>1,5</td><td>(Other)</td><td></td></tr>
<tr><td>Tests</td><td></td><td>Oral exam</td><td>1</td><td>(Other)</td><td></td></tr>
<tr><td>Written exam</td><td>1</td><td>Project</td><td>1</td><td>(Other)</td><td></td></tr>
<tr><td colspan="6"></td></tr>
<tr><td>Grading and evaluating student work in class and at the final exam</td><td colspan="6">The entire test can be applied over two partial tests during the semester. Passing threshold is 60%. Each test in assessing participates with 50%. Lectures presence of 80 to 100% is 10% marks. The examination periods there is a written and oral exam. Passing threshold is 60%. Passing one partial test of any part (previous activity) is valid throughout current academic year. Written exam has a share of 50% and oral examination also 50%. Students who have not passed the partial tests will have oral examination in the regular examination period. Passing threshold is 60% and the examination form to participate in the evaluation by 50%.

Rating: 60% -69% - satisfactory, 70% -79% - good, 80% -89% very good, 90% - 100% - excellent.</td></tr>
<tr><td rowspan="3">Required literature (available in the library and 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">1. D. A.Skoog, D. M. West, F. J. Holler, Fundamentals of Analytical Chemistry, Seventh Edition, Saunders College Publishing, New York, London, 1996. { šesto izdanje (englesko) 1992, prvo izdanje (hrvatsko), Školska knjiga, Zagreb, 1999.};</td><td>1.</td><td>Web page of the Department of Analytical Chemistry</td></tr>
<tr><td colspan="3">2.A. Skoog, D. M. West i F. J. Holler, S. R. Crouch, Fundamentals of Analytical Chemistry, 9th edition, Brooks&Cole, SAD, 2014.; 3.D.C.Harris, Quantitative Chemical Analysis, Eighth Edition,</td><td>6</td><td></td></tr>
</table>

	W.H.Freeman and Company, New York, 2010.		
	. R. Cornelis et al. Handbook of Elemental Speciation: Techniques and Methodology, Book News, Portland, 2004.	1	
Optional literature (at the time of submission of study programme proposal)			
Quality assurance methods that ensure the acquisition of exit competences	• registration of student's presence in class • annual analysis of students success in this course • student's survey in order to evaluate the professor • professor's self-evaluation		
Other (as the proposer wishes to add)			

3. STUDY PERFORMANCE CONDITIONS

3.1. Places of the study performance

Buildings of the constituent part (name existing, under construction and planned buildings)	
Identification of building	Three faculties building
Location of building	Ruđera Boškovića 35
Year of completion	2015.
Total square area in m^2	29500
Identification of building	Kaštel Sućurac building, z.k. 1053/1 i 1053/7
Location of building	Braće Radić 1, Kaštel Sućurac
Year of completion	1961.
Total square area in m^2	3000

3.2. List of teachers and associate teachers

Course	Teachers and associate teachers
Analytical environmental chemistry	PhD, Marija Bralić, associate prof. PhD, Maša Buljac, assistant prof.
Biochemical engineering	PhD, Davor Rušić, prof.
Chemical sensors and biosensors	Dr. Marijo Buzuk, assistant prof.
Chemistry and technology of aromatic plants	Dr. Igor Jerković, prof.
Chemistry of materials	PhD, Marija Bralić, associate prof. PhD, Maša Buljac, assistant prof. MSc, Goran Olujić, assistant
Chemometrics	PhD, Ante Prkić, assistant prof.
Colloid chemistry	PhD, Vesna Sokol, associate prof.
Diploma Thesis	
Energy and Development	PhD, Mirko Marušić, lecturer
Environmental menagment system	PhD, Marijo Buzuk, assistant prof. PhD, Maša Buljac, assistant prof.
Experimental seminar paper	
Flavour chemistry	PhD, Igor Jerković, prof.
General microbiology	PhD, Mirjana Skočibušić, associate prof. PhD, Ana Maravić, assistant prof.
Introduction to molecular biology	PhD, Olivera Politeo, associate prof. PhD, Tatjana Zemunik, prof.
Methods of separation and speciation	PhD, Josipa Giljanović, associate prof.
Microemulsions in applied chemistry	PhD, Vesna Sokol, associate pro.r PhD, Perica Bošković, assistant
Naturally occuring polymeric materials	PhD, Branka Andričić, prof.
Organic analysis	PhD, Ivica Blažević, assistant prof.

Organic synthesis	PhD, Ivica Blažević, assistant prof.
Physical biochemistry	PhD, Mladen Miloš, prof. PhD, Vesela Torlak, assistant
Physical chemistry of electrolyte solutions	PhD, Vesna Sokol, associate prof.
Physical methods of analysis	PhD, Ante Prkić, assistant prof.
Quality assurance and accreditation in laboratory practice	PhD, Josipa Giljanović, associate prof.
Quantum chemistry	PhD, Magdi Lučić Lavčević, associate prof.
Selected chapters from biochemistry	PhD, Olivera Politeo, associate prof.
Surface chemistry	PhD, Zoran Grubač, prof.
Synthesis of biologically active compounds	PhD, Ani Radonić, associate prof.

3.3. Curriculum vitae of the course teacher

First and last name and title of teacher	**PhD, Branka Andričić, prof.**
The course he/she teaches in the proposed study programme	Naturally Occuring Polymeric Materials (GC-OCB)
GENERAL INFORMATION ON COURSE TEACHER	
Address	Ruđera Boškovića 35, 21000 Split
Telephone number	++385 21 329 469
E-mail address	branka@ktf-split.hr
Personal web page	
Year of birth	1965
Scientist ID	188492
Research or art rank, and date of last rank appointment	Scientific advisor- November 14th, 2008
Research-and-teaching, art-and-teaching or teaching rank, and date of last rank appointment	Full professor, - December 23rd, 2010
Area and field of election into research or art rank	Technical Sciences, Chemical Engineering
INFORMATION ON CURRENT EMPLOYMENT	
Institution where employed	Faculty of Chemistry and Technology, University of Split
Date of employment	February 19th, 1991
Name of position (professor, researcher, associate teacher, etc.)	Full Professor
Field of research	Chemical Engineering in Materials Development
Function	Head of Department of Organic Technology
INFORMATION ON EDUCATION – Highest degree earned	
Degree	PhD
Institution	Faculty of Chemistry and Technology, University of Split
Place	Split
Date	December 19th, 2001
INFORMATION ON ADDITIONAL TRAINING	
Year	
Place	

Institution	
Field of training	
MOTHER TONGUE AND FOREIGN LANGUAGES	
Mother tongue	Croatian
Foreign language and command of foreign language on a scale from 2 (sufficient) to 5 (excellent)	English (4)
Foreign language and command of foreign language on a scale from 2 (sufficient) to 5 (excellent)	Italian (2)
Foreign language and command of foreign language on a scale from 2 (sufficient) to 5 (excellent)	
COMPETENCES FOR THE COURSE	
Earlier experience as course teacher of similar courses (name title of course, study programme where it is/was offered, and level of study programme)	1. Polymeric Materials – undergraduate study of Chemical Technology and Vocational study of Chemical Technology 2. Naturally Occurring Polymeric Materials – graduate study of Chemical Technology (Materials) 3. Polymeric Materials and the Environment- phD study Chemical Engineering in materials development and Environmental Protection
Authorship of university/faculty textbooks in the field of the course	B. Andričić, Prirodni polimerni materijali, University Handbook, Split, 2010.
Professional, scholarly and artistic articles published in the last five years in the field of the course (5 works at most)	1. I. Banovac, M. Erceg, **B. Andričić,** Usporedba utjecaja litijevog i natrijevog montmorilonita na kristalnost i toplinska svojstva poli(etilen glikola), *MATRIB 2013, International Conference on Materials, Tribology, Recycling, 27-29 June 2013, Vela Luka, p. 17-28.* 2. I. Banovac, M. Erceg, B. Andričić, M. Kursan, An investigation of the effect of lithium montmorillonite on the structure and thermal properties of poly(ethylene oxide), *13th Ružička days, Vukovar, september, 13-15, 2012, p. 100-107* 3. S. Perinović, B. Andričić, Influence of different processing techniques on the thermal properties of poly(L-lactide)olive stone flour composites, *15th European Conference on Composite Materials, Venice, 24-28 June 2012, p. 1-8* 4. S. Perinović, **B. Andričić**, Modifikacija svojstava poli(l-laktida), *Polimeri,* 33(2012) 3-4, 100-105
Professional and scholarly articles published in the last five years in subjects of teaching methodology and teaching quality (5 works at most)	
Professional, science and artistic projects in the field of the course carried out in the last five years (5 at most)	Polymer Blends with Biodegradable Components (011-1252971-2249)
The name of the programme and	

the volume in which the main teacher passed exams in/acquired the methodological-psychological-didactic-pedagogical group of competences?-pedagoške kompetencije?	
PRIZES AND AWARDS	
Prizes and awards for teaching and scholarly/artistic work	

First and last name and title of teacher	**PhD, Ivica Blažević, assistant prof.**
The course he/she teaches in the proposed study programme	Organic analysis (DK-OKB) Organic synthesis (DK-OKB)
GENERAL INFORMATION ON COURSE TEACHER	
Address	Ruđera Boškovića 35, 21000 Split, Croatia
Telephone number	00 385 (0) 21 329 434
E-mail address	blazevic@ktf-split.hr
Personal web page	http://ivicablazevic3.wix.com/blazevic
Year of birth	1974
Scientist ID	267194
Research or art rank, and date of last rank appointment	Senior Research Associate, 17. June 2015.
Research-and-teaching, art-and-teaching or teaching rank, and date of last rank appointment	Assistant professor, 28. November 2012.
Area and field of election into research or art rank	Natural sciences, chemistry
INFORMATION ON CURRENT EMPLOYMENT	
Institution where employed	Faculty of Chemistry and Technology, University of Split
Date of employment	1. December 2003.
Name of position (professor, researcher, associate teacher, etc.)	Assistant professor
Field of research	Organic chemistry
Function	
INFORMATION ON EDUCATION – Highest degree earned	
Degree	Ph.D.
Institution	University of Zagreb, Faculty of Sciences
Place	Zagreb
Date	23. October, 2009.
INFORMATION ON ADDITIONAL TRAINING	
Year	2002, 2003
Place	Monza-Italy
Institution	PerkinElmer referent centre
Field of training	Chromatography, Mass spectrometry, Infrared and UV/Vis spectroscopy
MOTHER TONGUE AND FOREIGN LANGUAGES	
Mother tongue	Croatian
Foreign language and command of foreign language on a scale from 2 (sufficient) to 5 (excellent)	English (5)
Foreign language and command of foreign language on a scale from 2 (sufficient) to 5 (excellent)	German (2)
Foreign language and command of foreign language on a scale from 2 (sufficient) to 5 (excellent)	
COMPETENCES FOR THE COURSE	
Earlier experience as course teacher of similar courses (name title of course, study programme where it is/was offered, and level of study programme)	
Authorship of university/faculty	

textbooks in the field of the course	
Professional, scholarly and artistic articles published in the last five years in the field of the course (5 works at most)	**Blažević, Ivica;** Montaut, Sabine; Rosalinda De Nicola, Gina; Rollin, Patrick. Long-chain Glucosinolates from *Arabis turrita*: Enzymatic and Non-enzymatic Degradations. // Natural product communications. 10 (2015) , 6; 1043-1046. **Blažević, Ivica;** Maleš, Tomislav; Ruščić, Mirko. Glucosinolates of *Lunaria annua*: Thermal, enzymatic, and chemical degradation. // Chemistry of natural compounds. 49 (2014) , 6; 1154-1157. **Blažević, Ivica;** Burčul, Franko; Ruščić, Mirko; Mastelić, Josip. Glucosinolates, volatile constituents, and acetylcholinesterase inhibitory activity of *Alyssoides utriculata*. // Chemistry of natural compounds. 49 (2013) , 2; 374-378. **Blažević, Ivica;** Rosalinda De Nicola, Gina; Montaut, Sabine; Rollin, Patrick. Glucosinolates in Two Endemic Plants of the *Aurinia* Genus and their Chemotaxonomic Significance. // Natural product communications. 8 (2013) , 10; 1463-1466. **Blažević, Ivica;** Radonić, Ani; Skočibušić, Mirjana; De Nicola, Gina R.; Montaut, Sabine; Iori, Renato; Rollin, Patrick; Mastelić, Josip; Zekić, Marina; and Maravić, Ana. Glucosinolate Profiling and Antimicrobial Screening of *Aurinia leucadea* (Brassicaceae). // Chemistry & biodiversity. 8 (2011), 12; 2310-2321.
Professional and scholarly articles published in the last five years in subjects of teaching methodology and teaching quality (5 works at most)	
Professional, science and artistic projects in the field of the course carried out in the last five years (5 at most)	Project leader (2013. – 2014). Bilateral Croatian-French project COGITO “Glucosinolates: novel sources and biological potential” Member of the project (2007. - 2013) Project 011-0982929-1329: "Essential oils and aromas – biologically active compounds and their modifications" under Ministry of Science, Education and Sports, in the frame of programm "Spectroscopy and modeling of bioactive molecules"
The name of the programme and the volume in which the main teacher passed exams in/acquired the methodological-psychological-didactic-pedagogical group of competences?-pedagoške kompetencije?	
PRIZES AND AWARDS, STUDENT EVALUATION	
Prizes and awards for teaching and scholarly/artistic work	
Results of student evaluation taken in the last five years for the course that is comparable to the course described in the form (evaluation organizer, average grade, note on grading scale and course evaluated)	average grade 4.9 – 5.0

First and last name and title of teacher	**PhD, Marija Bralić, associate prof.**
The course he/she teaches in the proposed study programme	Analytical Environmental Chemistry (GS) Chemistry of Materials (GS)
GENERAL INFORMATION ON COURSE TEACHER	
Address	Ruđer Bošković 35, 21000 Split, Croatia
Telephone number	00 385 (0) 21 329 477
E-mail address	bralic@ktf-split.hr
Personal web page	
Year of birth	1956.
Scientist ID	119816
Research or art rank, and date of last rank appointment	Senior Research Associate, 05. October 2012.
Research-and-teaching, art-and-teaching or teaching rank, and date of last rank appointment	Associate professor, 28. December 2012.
Area and field of election into research or art rank	Natural sciences, chemistry
INFORMATION ON CURRENT EMPLOYMENT	
Institution where employed	Faculty of Chemistry and Technology, University of Split
Date of employment	01. December 1982.
Name of position (professor, researcher, associate teacher, etc.)	Associate professor
Field of research	Environmental analyticl chemistry
Function	Head of department
INFORMATION ON EDUCATION – Highest degree earned	
Degree	Ph.D.
Institution	Faculty of Chemistry and Technology, University of Split
Place	Split
Date	18. July 1997.
INFORMATION ON ADDITIONAL TRAINING	
Year	
Place	
Institution	
Field of training	
MOTHER TONGUE AND FOREIGN LANGUAGES	
Mother tongue	Croatian
Foreign language and command of foreign language on a scale from 2 (sufficient) to 5 (excellent)	English, 3
Foreign language and command of foreign language on a scale from 2 (sufficient) to 5 (excellent)	
Foreign language and command of foreign language on a scale from 2 (sufficient) to 5 (excellent)	
COMPETENCES FOR THE COURSE	
Earlier experience as course teacher of similar courses (name title of course, study programme where it is/was offered, and level of study programme)	Environmental chemistry (PS) Exercises in Analytical chemistry (GS)
Authorship of university/faculty textbooks in the field of the course	
Professional, scholarly and artistic	**Bralić, Marija**; Buzuk, Marijo; Buljac, Maša; Brinić, Slobodan.

articles published in the last five years in the field of the course (5 works at most)	Potentiometric Studies on Chemically and Electrochemically Prepared Sulfide Active Materials for Determination of Copper(II), *International Journal of Electrochemical Science* **9** (2014); 4854-4865 Buljac,Maša; Bogner, Danijela; **Bralić, Marija**; Periš, Nenad; Buzuk, Marijo; Brinić, Slobodan; Vladislavić, Nives. Cadmium and Lead Distribution in Marine Soil Sediments, Terrestial Soil, Terrestial Rock, and Atmospheric Particulate Matter around Split, Croatia, *Amalytical Letters* **47** (2014), 11; 1952-1964 **Bralić, Marija**; Buljac, Maša; Buzuk, Marijo; Brinić, Slobodan. Interference Effect of Various Ions on Determination of Iron with Flow Injection Analysis using the Potentiometric Technique, *International Journal of Electrochemical Science* **7** (2012); 4; 2928-2937 Brinić, Slobodan; Buzuk, Marijo; **Bralić, Marija**; Buljac, Maša; Jozić, Dražan. Cu(II) Ion – Selective Electrode Based on Mixed Silver – Copper Sulfide: Phase Structure and Electrochemical Properties, *International Journal of Electrochemical Science* **7** (2012); 6; 5217-5230 Brinić, Slobodan; Buzuk, Marijo; **Bralić, Marija**; Generalić, Eni. Solid-contact Cu(II) ion-selective electrode based on 1,2 di (o-salicylaldiminophenylthio)ethane, *Journal of solid state electrochemistry* **16** (2012); 4; 1333-1341
Professional and scholarly articles published in the last five years in subjects of teaching methodology and teaching quality (5 works at most)	
Professional, science and artistic projects in the field of the course carried out in the last five years (5 at most)	
The name of the programme and the volume in which the main teacher passed exams in/acquired the methodological-psychological-didactic-pedagogical group of competences?-pedagoške kompetencije?	
PRIZES AND AWARDS, STUDENT EVALUATION	
Prizes and awards for teaching and scholarly/artistic work	
Results of student evaluation taken in the last five years for the course that is comparable to the course described in the form (evaluation organizer, average grade, note on grading scale and course evaluated)	

First and last name and title of teacher	PhD, Marijo Buzuk, assistant prof.
The course he/she teaches in the proposed study programme	Environmental Menagment System Chemical Sensors and Biosensors
GENERAL INFORMATION ON COURSE TEACHER	
Address	Ruđera Boškovića 35, 21 000 Split
Telephone number	021 329 474
E-mail address	buzuk@ktf-split.hr
Personal web page	-
Year of birth	1978.
Scientist ID	267150
Research or art rank, and date of last rank appointment	Research Associate; 17. july 2012.
Research-and-teaching, art-and-teaching or teaching rank, and date of last rank appointment	assistant professor, 28. november 2012.
Area and field of election into research or art rank	Natural science; Chemistry
INFORMATION ON CURRENT EMPLOYMENT	
Institution where employed	Faculty of Chemsitry and Technology, University of Split, Croatia
Date of employment	1. september 2004.
Name of position (professor, researcher, associate teacher, etc.)	assistant professor
Field of research	Analytical and Bioanalytical Chemistry, Electrochemistry, Environmental Chemistry
Function	Head of Department of General and Inogranic Chemistry
INFORMATION ON EDUCATION – Highest degree earned	
Degree	PhD
Institution	Faculty of Chemical Engineering and Chemistry
Place	Zagreb, Croatia
Date	3. september 2010.
INFORMATION ON ADDITIONAL TRAINING	
Year	2008.-2009.
Place	Graz, Austria
Institution	Institute for Analytical Chemsitry
Field of training	Analytical and Bioanalytical Chemistry
MOTHER TONGUE AND FOREIGN LANGUAGES	
Mother tongue	Croatian
Foreign language and command of foreign language on a scale from 2 (sufficient) to 5 (excellent)	English (4)
Foreign language and command of foreign language on a scale from 2 (sufficient) to 5 (excellent)	
Foreign language and command of foreign language on a scale from 2 (sufficient) to 5 (excellent)	
COMPETENCES FOR THE COURSE	
Earlier experience as course teacher of similar courses (name title of course, study programme where it is/was offered, and level of study programme)	Courses: 1. General chemistry 2. General chemistry with stoichiometry 3. General and Inorganic chemistry 4. Inorganic Chemistry 5. Water Chemistry

	6. Environmental Menagment system
Authorship of university/faculty textbooks in the field of the course	-
Professional, scholarly and artistic articles published in the last five years in the field of the course (5 works at most)	1. Buzuk, Marijo; Brinić Slobodan; Vladislavić Nives; Bralić, Marija; Buljac Masa; Škugor Rončević, Ivana. Real-time monitoring of “self-oxidation” of cysteine in presence of Cu2+: Novel findings in the oxidation mechanism. // *Monatshefte fur Chemie - Chemical Monthly*. 147 (2016); 359-367 2. Bralić, Marija; Buzuk, Marijo; Buljac, Maša; Brinić, Slobodan. Potentiometric Studies on Chemically and Electrochemically Prepared Sulfide Active Materials for Determination of Copper(II). // *International Journal of Electrochemical Science*. 9 (2014); 4854-4865 3. Brinić, Slobodan; Vladislavić, Nives; Buzuk, Marijo; Bralić, Marija; Šolić, Mislav. Bismuth film random array carbon fiber micro electrodes for determination of cysteine and N-acetyl cysteine. // *Journal of electroanalytical chemistry*. 705 (2013); 86-90 4. Brinić, Slobodan; Buzuk, Marijo; Bralić, Marija; Generalić, Eni. Solid-contact Cu(II) ion-selective electrode based on 1, 2 di (o salicylaldiminophenylthio)ethane. // *Journal of solid state electrochemistry*. 16 (2012); 1333-1341 5. Bralić, Marija; Buljac, Maša; Buzuk, Marijo; Brinić, Slobodan. Interference Effect of Various Ions on Determination of Iron with Flow Injection Analysis Using the Potentiometric Technique. // *International Journal of Electrochemical Science*. 7 (2012); 2928-2937
Professional and scholarly articles published in the last five years in subjects of teaching methodology and teaching quality (5 works at most)	
Professional, science and artistic projects in the field of the course carried out in the last five years (5 at most)	
The name of the programme and the volume in which the main teacher passed exams in/acquired the methodological-psychological-didactic-pedagogical group of competences?-pedagoške kompetencije?	
PRIZES AND AWARDS, STUDENT EVALUATION	

Prizes and awards for teaching and scholarly/artistic work	
Results of student evaluation taken in the last five years for the course that is comparable to the course described in the form (evaluation organizer, average grade, note on grading scale and course evaluated)	

First and last name and title of teacher	**PhD, Josipa Giljanović, associate prof.**
The course he/she teaches in the proposed study programme	Methods of Separation and Speciation Quality Assurance and Accreditation in Laboratory Practice
GENERAL INFORMATION ON COURSE TEACHER	
Address	Pujanke 69, Split
Telephone number	+38521329 476
E-mail address	josipa@ktf-split.hr
Personal web page	http://www.ktf-split.hr/~josipa
Year of birth	1959
Scientist ID	119831
Research or art rank, and date of last rank appointment	Senior Research, December 18, 2013
Research-and-teaching, art-and-teaching or teaching rank, and date of last rank appointment	Associate professor: 5 th february 2014
Area and field of election into research or art rank	Natural science, Chemistry,
INFORMATION ON CURRENT EMPLOYMENT	
Institution where employed	Faculty of Chemistry and Technology, Split,
Date of employment	First July 1984
Name of position (professor, researcher, associate teacher, etc.)	professor
Field of research	Designe and construction of potentiometric sensors, UV-VIS spectroscopy and AAS, FIA,
Function	Head of the department for Analytical Chemistry
INFORMATION ON EDUCATION – Highest degree earned	
Degree	Ph.D
Institution	Faculty of Chemistry and Technology,
Place	Split
Date	January 30, 1997
INFORMATION ON ADDITIONAL TRAINING	
Year	
Place	
Institution	
Field of training	
MOTHER TONGUE AND FOREIGN LANGUAGES	
Mother tongue	Croatian
Foreign language and command of foreign language on a scale from 2 (sufficient) to 5 (excellent)	English, excellent
Foreign language and command of foreign language on a scale from 2 (sufficient) to 5 (excellent)	Italian, sufficient
Foreign language and command of foreign language on a scale from 2 (sufficient) to 5 (excellent)	
COMPETENCES FOR THE COURSE	
Earlier experience as course teacher of similar courses (name title of course, study programme where it is/was offered, and level of study programme)	Physical methods of analysis, Methods of separation and speciation, Accreditation and organissation of laboratories, graduate study chemistry Analytical chemistry, Professional Study of Chemical Technology Quality assurance of food graduate study of Chemical Technology; Mediterranean culture; Analysis of food products, food quality

	assurance, the Professional Study of Chemical Technology,
Authorship of university/faculty textbooks in the field of the course	J. Giljanović, Qualitative analysis- practicum, university manual, 2009th, J. Giljanović, Analysis of food products: instructions for exercises, professional studies, food technology J. Giljanović, Ensuring food quality: guidelines for exercise, professional studies, food technology J. Komljenović, Exercises in analytical chemistry, reviewed material for students of university study biology and ecology, 2004th E. Generalić S. Krka, M. Bralić J. Komljenović, Analytical Chemistry, practicum, 2003rd
Professional, scholarly and artistic articles published in the last five years in the field of the course (5 works at most)	1. T. Vukušić, A. Prkić, **J. Giljanović**, V. Sokol, P. Bošković, Direct Potentiometric Determination of Penicillamine in Real Samples by Using Copper ISE., *Croatica chemica acta*. 88 (2015) , 3; 255-258; 2. M. Brkljača, **J. Giljanović**, A. Prkić: Determination of Metal sin Olive Oil by Electrothermal Atomic Apsorption Spectrometry: Validation and Uncertainity Measurements, Analytical letters; **46** (2013) ; 2912-2926. 3. **J. Giljanović,** A. Prkić, M. Bralić, M. Brkljača, Determination of Fluoride Content in Tea Infusion by Using Fluoride Ion-Selective Electrode.; International journal of electrochemical Science, **7** (2012), 4; 2918-2927. 4. A. Prkić, **J. Giljanović,** M. Bralić, K. Boban, Direct Potentiometric Determination of Fluoride Species by Using Ion-Selective Fluoride Electrode., International Journal of Electrochemical Science. **7** (2012); 1170-1179. 5. **J. Giljanović,** M. Brkljača, A. Prkić, Flow injection spectrophotometric determination of N-Acetyl-L-cysteine as a complex with palladium(II)., Molecules, **16** (2011), 9; 7224-7236.
Professional and scholarly articles published in the last five years in subjects of teaching methodology and teaching quality (5 works at most)	Book chapter: Ivka Klarić, Višnja Katalinić, Josipa Giljanović and Jana Šurjak, Design and Construction of Food Premises, 158714-TEMUS-ES-TEMPUS-JPHES, Improving Academia-Industry Links in Food Safety and Quality, (ur Javier Arántegui Jiminéz) Split, 2011. str: 76-81; 85-90;91-103;; e-learning course: Total quolity menagement system; e- learning; www.foodlinks.eu; and elearning.foodlinks.eu (Quality management system (ISO 9001)
Professional, science and artistic projects in the field of the course carried out in the last five years (5 at most)	Tempus project 158714- Improvin academia-industry links in food safety and quality, ,Universidad de Lleida, Spain, 2010-2013.
The name of the programme and the volume in which the main teacher passed exams in/acquired the methodological-psychological-didactic-pedagogical group of competences?-pedagoške kompetencije?	Analytical Chemistry, University course (lecture, seminars and laboratory exercises)
PRIZES AND AWARDS, STUDENT EVALUATION	
Prizes and awards for teaching and scholarly/artistic work	
Results of student evaluation taken in the last five years for the course that is comparable to the course	

described in the form (evaluation organizer, average grade, note on grading scale and course evaluated)	

First and last name and title of teacher	**PhD, Zoran Grubač, prof.**
The course he/she teaches in the proposed study programme	General Chemistry
GENERAL INFORMATION ON COURSE TEACHER	
Address	Faculty of Chemistry and Technology, Ruđera Boškovića 33, 21 000 Split
Telephone number	091 502 0029
E-mail address	grubac@ktf-split.hr
Personal web page	http://www.ktf-split.hr/~grubac/
Year of birth	1960.
Scientist ID	126072
Research or art rank, and date of last rank appointment	Science adviser, 2. October 2013.
Research-and-teaching, art-and-teaching or teaching rank, and date of last rank appointment	Full professor 19. December 2013.
Area and field of election into research or art rank	Natural science; Chemistry
INFORMATION ON CURRENT EMPLOYMENT	
Institution where employed	Faculty of Chemistry and Technology, University of Split, Croatia
Date of employment	1. September 1985.
Name of position (professor, researcher, associate teacher, etc.)	professor
Field of research	Electrochemistry, Inorganic chemistry
Function	Head of Department of general and inorganic chemistry
INFORMATION ON EDUCATION – Highest degree earned	
Degree	PhD
Institution	Faculty of Chemical Engineering and Chemistry
Place	Zagreb, Croatia
Date	12. November 1996.
INFORMATION ON ADDITIONAL TRAINING	
Year	
Place	
Institution	
Field of training	
MOTHER TONGUE AND FOREIGN LANGUAGES	
Mother tongue	Croatian
Foreign language and command of foreign language on a scale from 2 (sufficient) to 5 (excellent)	English (4)
Foreign language and command of foreign language on a scale from 2 (sufficient) to 5 (excellent)	
Foreign language and command of foreign language on a scale from 2 (sufficient) to 5 (excellent)	
COMPETENCES FOR THE COURSE	
Earlier experience as course teacher of similar courses (name title of course, study programme where it is/was offered, and level of study programme)	Courses: General Chemistry and Inorganic Chemistry at Undergraduate Study of Chemistry and Undergraduate Study of Chemical Engineering at Faculty of Chemistry and Technology Split and Undergraduate study Marine Biology and Ecology at University Department of Marine Studies, University of Split.

	Inorganic Chemistry at Undergraduate study Biology and Chemistry at Faculty of Science, University of Split. General and Inorganic Chemistry at Integrated undergraduate and graduate study of Pharmacy at Faculty of Chemistry and Technology Split and School of Medicine in Split.
Authorship of university/faculty textbooks in the field of the course	1. Z. Grubač, Lectures from general chemistry, Faculty of Chemistry and Technology, Split, 2007. 2. Z. Grubač, Lectures from inorganic chemistry, Faculty of Chemistry and Technology, Split, 2007.
Professional, scholarly and artistic articles published in the last five years in the field of the course (5 works at most)	1. Z. Grubač, I. Škugor Rončević, M. Metikoš-Huković, Corrosion properties of the Mg alloy coated with polypyrrole films, Corros. Sci. 102 (2016) 310-316. 2. I. Škugor Rončević, Z. Grubač, M. Metikoš-Huković, Electrodeposition of Hydroxyapatite Coating on AZ91D Alloy for Biodegradable Implant Application, Int. J. Electrochem. Sci., 9 (2014) 5907 - 5923 3. Z. Grubač, M. Metikoš-Huković, R. Babić, Nanocrystalline and coarse grained polycrystalline nickel catalysts for the hydrogen evolution reaction, International Journal of Hydrogen Energy, 38 (2013) 4437-4444. 4. Z. Grubač, M. Metikoš-Huković, R. Babić, I. Škugor Rončević, M. Petravić, R. Peter, Functionalization of biodegradable magnesium alloy implants with alkylphosphonate self-assembled films, Mater. Sci. Eng. C 33 (2013) 2152-2158. 5. M. Metikoš-Huković, R. Babić, I. Škugor Rončević, Z. Grubač, Corrosion Behavior of the Filmed Copper Surface in Saline Water under Static and Jet Impingement Conditions, Corrosion 68 (2012) 025002-1-025002.
Professional and scholarly articles published in the last five years in subjects of teaching methodology and teaching quality (5 works at most)	
Professional, science and artistic projects in the field of the course carried out in the last five years (5 at most)	1. Bilateral Croatian-Slovenian project: Bioengineering metal materials and functional coatings for medical application, from 2010. to 2011. 2. Project 125-0982904-2932 “New materials and catalysts for sustainable technologies; from 2002. to 2013.
The name of the programme and the volume in which the main teacher passed exams in/acquired the methodological-psychological-didactic-pedagogical group of competences?-pedagoške kompetencije?	
PRIZES AND AWARDS, STUDENT EVALUATION	
Prizes and awards for teaching and scholarly/artistic work	
Results of student evaluation taken in the last five years for the course that is comparable to the course described in the form (evaluation organizer, average grade, note on grading scale and course evaluated)	

First and last name and title of teacher	**PhD, Igor Jerković, prof.**
The course he/she teaches in the proposed study programme	Chemistry and technology of aromatic herbs Flavour chemistry
GENERAL INFORMATION ON COURSE TEACHER	
Address	Ruđera Boškovića 35, 21000 Split
Telephone number	00385 21 329 436
E-mail address	igor@ktf-split.hr
Personal web page	-
Year of birth	1975
Scientist ID	226253
Research or art rank, and date of last rank appointment	Research adviser (16 February 2011)
Research-and-teaching, art-and-teaching or teaching rank, and date of last rank appointment	full professor (07. December 2012)
Area and field of election into research or art rank	scientific area of natural sciences, scientific filed chemistry
INFORMATION ON CURRENT EMPLOYMENT	
Institution where employed	Faculty of Chemistry and Technology, University of Split
Date of employment	01 September 1998
Name of position (professor, researcher, associate teacher, etc.)	full professor
Field of research	natural organic compounds
Function	dean
INFORMATION ON EDUCATION – Highest degree earned	
Degree	Ph. D. (chemistry)
Institution	Faculty of Chemistry and Technology, University of Split
Place	Split
Date	28 May 2004
INFORMATION ON ADDITIONAL TRAINING	
Year	2005 (three months); (2010.-2015. occasionally)
Place	Rome and Cagliari, Italy
Institution	Universita degli studi di Roma „La Sapienza“ and Universita degli studi di Cagliari, Italia
Field of training	natural organic compounds
MOTHER TONGUE AND FOREIGN LANGUAGES	
Mother tongue	Croatian
Foreign language and command of foreign language on a scale from 2 (sufficient) to 5 (excellent)	English (5)
Foreign language and command of foreign language on a scale from 2 (sufficient) to 5 (excellent)	Italian (3)
Foreign language and command of foreign language on a scale from 2 (sufficient) to 5 (excellent)	-
COMPETENCES FOR THE COURSE	
Earlier experience as course teacher of similar courses (name title of course, study programme where it is/was offered, and level of study programme)	Chemistry and technology of aromatic plants (graduate study in Chemistry), Flavour chemistry (graduate study in chemistry)
Authorship of university/faculty textbooks in the field of the course	-

Professional, scholarly and artistic articles published in the last five years in the field of the course (5 works at most)	• I. Jerković, J. Družić, Z. Marijanović, M. Gugić, S. Jokić and M. Roje, GC-FID/MS Profiling of Supercritical CO_2 Extracts of Peels from *Citrus aurantium*, *C. sinensis* cv. Washington navel, *C. sinensis* cv. Tarocco and *C. sinensis* cv. Doppio Sanguigno from Dubrovnik Area (Croatia), Natural Product Communications 10 (2015) 1315-1318. • P. M. Kuś, Z. Marijanović and I. Jerković, Evaluation of HS-SPME and ultrasonic solvent extraction for monitoring of plant flavours added by the bees to herbhoneys: traceability biomarkers, *Food Additives and Contaminants* 32 (2015) 1761-1771. • I. Jerković and P. M. Kuś, Terpenes in Honey: Occurence, Origin and Their Role as Chemical Biomarkers, *RSC Advances* 4 (2014) 31710-31728. • I. Jerković, M. Obradović, P. M. Kuś and M. Šarolić, Bioorganic Diversity of Rare *Coriandrum sativum* L. Honey: Unusal Chromatographic Profiles Containing Derivatives of Linalool/Oxygenated Methoxybenzene, *Chemistry & Biodiversity* 10 (2013) 1549-1558. • I. Jerković, M. Marasović, Z. Marijanović, K. Hazler Pilepić, Ž. Maleš and M. Miloš, Chemical Composition of Hypericum richeri subsp. grisebachii Essential Oil from Croatia, *Natural Product Communications* 8 (2013) 231-233.
Professional and scholarly articles published in the last five years in subjects of teaching methodology and teaching quality (5 works at most)	-
Professional, science and artistic projects in the field of the course carried out in the last five years (5 at most)	• Leader of research project HRZZ-IP-11-2013-8547: *Research of Natural Products and Flavours: Chemical Fingerprinting and Unlocking the Potential (NaPro-Flav)*, Croatian Science Foundation (01 June 2014. -)
The name of the programme and the volume in which the main teacher passed exams in/acquired the methodological-psychological-didactic-pedagogical group of competences?-pedagoške kompetencije?	-
PRIZES AND AWARDS, STUDENT EVALUATION	
Prizes and awards for teaching and scholarly/artistic work	• The award for scientific achievement, "Ruđer Bošković", University of Split on November 29, 2013. • The award for special achievements in scientific and educational work, Faculty of Chemical Technology in Split, October 22, 2011. • The "Leopold (Lavoslav) Ružička" Award of Croatian Chemical Society for young scientists for outstanding results achieved in the field of chemistry of natural compounds, Zagreb, October 19, 2006.
Results of student evaluation taken in the last five years for the course that is comparable to the course described in the form (evaluation organizer, average grade, note on grading scale and course evaluated)	

First and last name and title of teacher	**PhD, Magdy Lučić Lavčević, associate prof.**
The course he/she teaches in the proposed study programme	Quantum Chemistry, GC-OC, GC-CE
GENERAL INFORMATION ON COURSE TEACHER	
Address	Ruđera Boškovića 35, 21 000 Split
Telephone number	+385-21-329 449
E-mail address	malula@ktf-split.hr
Personal web page	
Year of birth	1957.
Scientist ID	118 560
Research or art rank, and date of last rank appointment	
Research-and-teaching, art-and-teaching or teaching rank, and date of last rank appointment	Associate professor, 2013.
Area and field of election into research or art rank	Natural sciences, physics
INFORMATION ON CURRENT EMPLOYMENT	
Institution where employed	Faculty of Chemistry and Technology
Date of employment	1982.
Name of position (professor, researcher, associate teacher, etc.)	Professor
Field of research	Experimental physics of condensed matter
Function	Head of the Physics department
INFORMATION ON EDUCATION – Highest degree earned	
Degree	PhD
Institution	Faculty of Natural Sciences
Place	Zagreb
Date	28.12.1998.
INFORMATION ON ADDITIONAL TRAINING	
Year	1991. 1997/1998/2003.
Place	Zagreb Zagreb, Basovizza
Institution	Faculty of Natural Sciences Ruđer Bošković Institute /Sincrotrone Elettra
Field of training	Experimental phyisics of condensed matter
MOTHER TONGUE AND FOREIGN LANGUAGES	
Mother tongue	Croatian
Foreign language and command of foreign language on a scale from 2 (sufficient) to 5 (excellent)	English - 5
Foreign language and command of foreign language on a scale from 2 (sufficient) to 5 (excellent)	French - 4
Foreign language and command of foreign language on a scale from 2 (sufficient) to 5 (excellent)	Italian - 2
COMPETENCES FOR THE COURSE	
Earlier experience as course teacher of similar courses (name title of course, study programme where it is/was offered, and level of	

study programme)	
Authorship of university/faculty textbooks in the field of the course	
Professional, scholarly and artistic articles published in the last five years in the field of the course (5 works at most)	1. M. Lučić Lavčević, P. Dubček, S. Bernstorff, M. Pavlović, L. Šilović, *A grazing-incidence small-angle X-ray scattering view of vertically aligned ZnO nanowires,* J. Nanomater. 2013 (2013) 381519 2. M. Lučić Lavčević, S. Bernstorff, P. Dubček, D. Jozić, I. Jerković, Z. Marijanović, *GISAXS/GIXRD view of ZnO films with hierarchical structural elements,* J. Nanotechnol. 2012 (2012) 354809 3. M. Lučić Lavčević, A. Turković, P. Dubček, Z. Crnjak Orel, B. Orel, S. Bernstorff, *GISAXS view of induced morphological changes in of nanostructured CeVO4 thin films,* J. Nanomater. 2011 (2011) 303808
Professional and scholarly articles published in the last five years in subjects of teaching methodology and teaching quality (5 works at most)	
Professional, science and artistic projects in the field of the course carried out in the last five years (5 at most)	Croatian MSES: Nanostructures of metals and metal oxides: morphology and properties, 2007-2013 - leadership RCOP: MEMSplit (Strengthening the Capacities for Application and Technology Transfer of Microelectromehanical Systems at the University of Split), 2014-2016 - participation
The name of the programme and the volume in which the main teacher passed exams in/acquired the methodological-psychological-didactic-pedagogical group of competences?-pedagoške kompetencije?	
PRIZES AND AWARDS, STUDENT EVALUATION	
Prizes and awards for teaching and scholarly/artistic work	

First and last name and title of teacher	**PhD, Mirko Marušić, lecturer**
The course he/she teaches in the proposed study programme	Energy and development
GENERAL INFORMATION ON COURSE TEACHER	
Address	Biskupa Jurja Dobrile13/8, 21000 Split, Republic of Croatia
Telephone number	021/466-484
E-mail address	mmarusic@ktf-split.hr
Personal web page	
Year of birth	1971.
Scientist ID	337170
Research or art rank, and date of last rank appointment	
Research-and-teaching, art-and-teaching or teaching rank, and date of last rank appointment	senior lecturer, December 12th 2013
Area and field of election into research or art rank	natural sciences, field of physics
INFORMATION ON CURRENT EMPLOYMENT	
Institution where employed	Faculty of Chemistry and Technology, University of Split
Date of employment	January, 9th 2014
Name of position (professor, researcher, associate teacher, etc.)	senior lecturer
Field of research	physics
Function	
INFORMATION ON EDUCATION – Highest degree earned	
Degree	PhD
Institution	Faculty of Natural Sciences and Mathematics
Place	Sarajevo
Date	March 5th 2013
INFORMATION ON ADDITIONAL TRAINING	
Year	
Place	
Institution	
Field of training	
MOTHER TONGUE AND FOREIGN LANGUAGES	
Mother tongue	Croatian
Foreign language and command of foreign language on a scale from 2 (sufficient) to 5 (excellent)	English (4)
Foreign language and command of foreign language on a scale from 2 (sufficient) to 5 (excellent)	
Foreign language and command of foreign language on a scale from 2 (sufficient) to 5 (excellent)	
COMPETENCES FOR THE COURSE	
Earlier experience as course teacher of similar courses (name title of course, study programme where it is/was offered, and level of study programme)	• Music acoustics Undergraduate programme of Music art of Composition Art academy, University of Split • Physics Professional study – Chemical technology and materials Professional study – Food technology Professional study – Materials protection and recycling Undergraduate study - Food technology

	Faculty of Chemistry and Technology, University of Split
Authorship of university/faculty textbooks in the field of the course	
Professional, scholarly and artistic articles published in the last five years in the field of the course (5 works at most)	
Professional and scholarly articles published in the last five years in subjects of teaching methodology and teaching quality (5 works at most)	1. Marušić, Mirko; Sliško, Josip. Students' Experiences in Learning Physics: Active Learning Methods and Traditional Teaching.// Latin-American Journal of Physics Education. 8 (2014), 4, 1-12. 2. Marušić, Mirko; Sliško, Josip. Influence of Three Different Methods of Teaching Physics on the Gain in Students' Development of Reasoning. // International Journal of Science Education. 34 (2012) , 2; 301-326. 3. Marušić, Mirko; Sliško, Josip. Effects of two different types of physics learning on the results of CLASS test. // Physical Review Special Topics. Physics Education Research. 8 (2012). 4. Erceg, Nataša; Marušić, Mirko; Sliško, Josip. Students' strategies for solving partially specified physics problems. // Revista Mexicana de Fisica E. 57 (2011) , 1; 44-50. 5. Marušić, Mirko; Erceg, Nataša; Sliško, Josip. Partially specified physics problems: university students' attitudes and performance. // European journal of physics. 32 (2011) , 3; 711-722.
Professional, science and artistic projects in the field of the course carried out in the last five years (5 at most)	
The name of the programme and the volume in which the main teacher passed exams in/acquired the methodological-psychological-didactic-pedagogical group of competences?	2007 – Postgraduate study – Didactics of natural sciences – Physics; Faculty of Natural Sciences and Mathematics, University of Split 1996 – Undergraduate study programme – course of study: mathematics and physics teacher, Faculty of Natural Sciences and Mathematics, University of Split
PRIZES AND AWARDS, STUDENT EVALUATION	
Prizes and awards for teaching and scholarly/artistic work	
Results of student evaluation taken in the last five years for the course that is comparable to the course described in the form (evaluation organizer, average grade, note on grading scale and course evaluated)	

First and last name and title of teacher	**PhD, Mladen Miloš, prof.**
The course he/she teaches in the proposed study programme	Physical biochemistry
GENERAL INFORMATION ON COURSE TEACHER	
Address	Ruđera Boškovića 33, 21000 Split
Telephone number	0977410899
E-mail address	milos@ktf-split.hr
Personal web page	http://tkojetko.irb.hr/znanstvenikDetalji.php?sifznan=6547
Year of birth	1956
Scientist ID	211625
Research or art rank, and date of last rank appointment	Scientific advisor (15. 02. 2005.)
Research-and-teaching, art-and-teaching or teaching rank, and date of last rank appointment	Full professor (18. 01. 2010.)
Area and field of election into research or art rank	Sciences, Chemistry, Biochemistry and medicinal chemistry
INFORMATION ON CURRENT EMPLOYMENT	
Institution where employed	Faculty of chemistry end technology
Date of employment	1993
Name of position (professor, researcher, associate teacher, etc.)	Professor
Field of research	Biochemistry
Function	Head of Department of biochemistry
INFORMATION ON EDUCATION – Highest degree earned	
Degree	Ph.D.
Institution	Faculty of Sciences
Place	Geneva
Date	1989
INFORMATION ON ADDITIONAL TRAINING	
Year	2002
Place	Marseille, France
Institution	Unicerity of Provence
Field of training	Natural products
MOTHER TONGUE AND FOREIGN LANGUAGES	
Mother tongue	Croatian
Foreign language and command of foreign language on a scale from 2 (sufficient) to 5 (excellent)	French (5)
Foreign language and command of foreign language on a scale from 2 (sufficient) to 5 (excellent)	English (2)
Foreign language and command of foreign language on a scale from 2 (sufficient) to 5 (excellent)	
COMPETENCES FOR THE COURSE	
Earlier experience as course teacher of similar courses (name title of course, study programme where it is/was offered, and level of study programme)	Introduction in biochemistry, Biochemistry I and II, Physical biochemistry
Authorship of university/faculty textbooks in the field of the course	Lectures for courses "Basic biochemistry"
Professional, scholarly and artistic	1.S. Ivankovic, R. Stojkovic, Z. Galic, B. Galic, J. Ostojic, M.

articles published in the last five years in the field of the course (5 works at most)	Marasovic, M. Milos, In vitro and in vivo antitumor activity of the halogenated boroxine dipotassium trioxohydroxy-tetrafluorotriborate K2[b3O3F4OH]. *Journal of enzyme inhibition and medicinal chemistry.* 30 (2015) 3; 354-359. 2. D. Vullo, **M. Milos**, B. Galic, A. Scozzafava, C.T. Supuran, Dipotassium trioxohydroxytetrafluorotriborate K2[b3O3F4OH] is a potent inhibitor of human carbonic anhydrases. *Journal of enzyme inhibition and medicinal chemistry.* 30 (2015) 2; 341-344. 3. S. Islamović, B. Galic, **M. Miloš**, A study of the inhibition of catalase by dipotassium trioxohydroxytetrafluorotriborate K2[b3O3F4OH]. *Journal of enzyme inhibition and medicinal chemistry.* 29 (2014) 5; 744-748. 4. **M. Miloš**, D. Makota, Investigation of antioxidant synergisms and antagonisms among thymol, carvacrol, thymoquinone and p-cymene in a model system using the Briggs–Rauscher oscillating reaction. *Food Chemistry*, **131** (2012) 1; 296-299. K. Carović-Stanko, Z. Liber, O. Politeo, F. Strikić, I. Kolak, **M. Miloš**, Z. Šatović, Molecular and chemical characterization of the most widespread Ocimum species. Plant *systematics and evolution*, **294** (2011) 3; 253-262
Professional and scholarly articles published in the last five years in subjects of teaching methodology and teaching quality (5 works at most)	-
Professional, science and artistic projects in the field of the course carried out in the last five years (5 at most)	- Antioxidative constituents and cholinesterase inhibitors from aromatic herbs - Investigation of bioactive compounds from Dalmatian plants: their antioxidant, enzyme inhibition and health properties
The name of the programme and the volume in which the main teacher passed exams in/acquired the methodological-psychological-didactic-pedagogical group of competences?-pedagoške kompetencije?	University undergraduate study in chemistry Graduate study in chemistry Integrated undergraduate and graduate study of Pharmacy Study of chemical technology
PRIZES AND AWARDS, STUDENT EVALUATION	
Prizes and awards for teaching and scholarly/artistic work	Award of Faculty of chemistry and technology
Results of student evaluation taken in the last five years for the course that is comparable to the course described in the form (evaluation organizer, average grade, note on grading scale and course evaluated)	Evaluation organizer: University of Split Biochemistry average grade: 4,6 Introduction in biochemistry average grade: 4,8 Physical biochemistry average grade: 4,8

First and last name and title of teacher	**PhD, Olivera Politeo, asociate prof.**
The course he/she teaches in the proposed study programme	**INTRODUCTION TO MOLECULAR BIOLOGY** **SELECTED CHAPTERS FROM BIOCHEMISTRY**
GENERAL INFORMATION ON COURSE TEACHER	
Address	Rudjera Boskovica 35
Telephone number	
E-mail address	olivera@ktf-split.hr
Personal web page	
Year of birth	1969
Scientist ID	259103
Research or art rank, and date of last rank appointment	Senior scientific associate (Natural Science / Chemistry) 18.12.2013.
Research-and-teaching, art-and-teaching or teaching rank, and date of last rank appointment	Associate Professor (Natural Science / Chemistry / Biochemistry and Medicinal Chemistry) 05.02.2014.
Area and field of election into research or art rank	Natural Science / Chemistry / Biochemistry and Medicinal Chemistry
INFORMATION ON CURRENT EMPLOYMENT	
Institution where employed	Faculty of Chemistry and Technology
Date of employment	Decembre 01 2003.
Name of position (professor, researcher, associate teacher, etc.)	Assoc. Prof. Department of Biochemistry
Field of research	Chemistry and biochemistry of natural products
Function	
INFORMATION ON EDUCATION – Highest degree earned	
Degree	PhD
Institution	Faculty of Science
Place	Zagreb,Croatia
Date	March 09 2007
INFORMATION ON ADDITIONAL TRAINING	
Year	
Place	
Institution	
Field of training	
MOTHER TONGUE AND FOREIGN LANGUAGES	
Mother tongue	Croatian
Foreign language and command of foreign language on a scale from 2 (sufficient) to 5 (excellent)	English, 4
Foreign language and command of foreign language on a scale from 2 (sufficient) to 5 (excellent)	French, 3
Foreign language and command of foreign language on a scale from 2 (sufficient) to 5 (excellent)	
COMPETENCES FOR THE COURSE	
Earlier experience as course teacher of similar courses (name title of course, study programme where it is/was offered, and level of study programme)	Biochemistry 1 and Biochemistry 2 (Undergraduate study of Chemistry), Biochemistry (Graduate study of Chemical Technology), General Biochemistry and Applied Biochemistry (Integrate Undergraduate and Graduate Study of Pharmacy), Introduction to molecular biology (Graduate Study of Chemistry)
Authorship of university/faculty textbooks in the field of the course	
Professional, scholarly and artistic	Siracusa Laura, Kulišić-Bilušić Tea, **Politeo Olivera,** Krause

articles published in the last five years in the field of the course (5 works at most)	Ingolf, Dejanović Branka, Ruberto Giuseppe. Phenolic composition and antioxidant acivity of aqueous infusions from Capparis spinosa L. and Crithmum maritimum L. before and the after submission to a two-step in vitro digestion model. // Journal of agricultural and food chemistry. 59 (2011), 23; 12453-12459. **Olivera Politeo**, Mirjana Skocibusic, Franko Burcul, Ana Maravic, Ivana Carev, Mirko Ruscic, Mladen Milos. *Campanula portenschlagiana Roem. et Schult.: Chemical and Biological Profile*. Chemistry & biodiversity **10**, 2013, 1072-1080. Klaudija Carović-Stanko, Zlatko Liber, **Olivera Politeo**, Frane Strikić, Ivan Kolak, Mladen Milos, Zlatko Satovic. *Molecular and chemical characterisation of the most widespread Ocimum species.*Plant Systematics and Evolution **294,** 2011, 253-262. Zlatko Liber, Klaudija Carović-Stanko, **Olivera Politeo**, Frane Strikić, Ivan Kolak, Mladen Milos, Zlatko Satovic. *Chemical Characterisation and Genetic Relationships among Ocimum basilicum L. Cultivars.*Chemistry & Biodiversity **8,** 2011, 1978-1989. **Olivera Politeo**, Mirjana. Skocibusic, Ana Maravic, Mirko Ruscic, Mladen Milos. *Chemical Composition and Antimicrobial Activity of the Essentail Oil of Endemic Dalmatian Black Pine (Pinus nigra ssp. dalmatica).*Chemistry & Biodiversity **8,** 2011, 540-547.
Professional and scholarly articles published in the last five years in subjects of teaching methodology and teaching quality (5 works at most)	
Professional, science and artistic projects in the field of the course carried out in the last five years (5 at most)	"The study of bioactive compounds from Dalmatian plants: their antioxidant character and impact on enzyme inhibition and health" HRZZ: IP-2014-09-6897, 2015-today. "Antioxidant compounds and cholinesterase inhibitors from aromatic plants" (011-2160547-1330), Ministry of Science, Croatia, 2008 -2014. "Antioxidant effect of volatile compounds from aromatic plants" (0011003), Ministry of Science, Croatia, 2003-2007.
The name of the programme and the volume in which the main teacher passed exams in/acquired the methodological-psychological-didactic-pedagogical group of competences?-pedagoškekompetencije?	Methodical, Psychological and Didactic Courses (Graduate study of Chemistry and Biology). Teching (Chemistry) and Government Institution Licence, 1996
PRIZES AND AWARDS, STUDENT EVALUATION	
Prizes and awards for teaching and scholarly/artistic work	
Results of student evaluation taken in the last five years for the course that is comparable to the course	

described in the form (evaluation organizer, average grade, note on grading scale and course evaluated)	

First and last name and title of teacher	PhD, Ante Prkić, assistant prof.
The course he/she teaches in the proposed study programme	Chemometrics Physical Methods of Analysis
GENERAL INFORMATION ON COURSE TEACHER	
Address	Ruđera Boškovića 35
Telephone number	021329462
E-mail address	prkic@ktf-split.hr
Personal web page	
Year of birth	1981
Scientist ID	313112
Research or art rank, and date of last rank appointment	Associate Scientist, March 12th 2014.
Research-and-teaching, art-and-teaching or teaching rank, and date of last rank appointment	Assistant Professor, May 1st 2014.
Area and field of election into research or art rank	Natural Sciences, Chemistry
INFORMATION ON CURRENT EMPLOYMENT	
Institution where employed	Faculty of Chemistry and Technology
Date of employment	April 20th 2006.
Name of position (professor, researcher, associate teacher, etc.)	Assistant Professor
Field of research	Development of ion-selective membranes for potentiometric determinations, flow-injection analysis, UV/Vis spectrophotometry, Atomic spectroscopy, Theoretical chemistry
Function	Assistant Professor
INFORMATION ON EDUCATION – Highest degree earned	
Degree	PhD
Institution	Faculty of Chemical Engineering and Technology, University of Zagreb
Place	Zagreb
Date	September 30th 2013.
INFORMATION ON ADDITIONAL TRAINING	
Year	2006
Place	Klis
Institution	SMS
Field of training	Atomic spectroscopy
MOTHER TONGUE AND FOREIGN LANGUAGES	
Mother tongue	Croatian
Foreign language and command of foreign language on a scale from 2 (sufficient) to 5 (excellent)	English (5)
Foreign language and command of foreign language on a scale from 2 (sufficient) to 5 (excellent)	German (4)
Foreign language and command of foreign language on a scale from 2 (sufficient) to 5 (excellent)	
COMPETENCES FOR THE COURSE	
Earlier experience as course teacher of similar courses (name title of course, study programme where it is/was offered, and level of study programme)	Assistant for various experimental teachings in Analytical Chemistry

Authorship of university/faculty textbooks in the field of the course	• Ante Prkić, Vježbe iz Analitičke kemije, Undergraduate study of Chemical Technology, Split 2008. • Ante Prkić, Vježbe iz Analitičke kemije II, Undergraduate study of Chemistry, Split 2011. • Josipa Giljanović, Ante Prkić, Vježbe iz Fizikalnih metoda analize, Graduate study of Chemistry, Split 2009. • Ante Prkić, Josipa Giljanović, Vježbe iz Metoda odvajanja i specijacije, Graduate study of Chemistry, Split 2009.
Professional, scholarly and artistic articles published in the last five years in the field of the course (5 works at most)	1. Prkić, Ante; Giljanović, Josipa; Bralić, Marija; Boban, Katarina. Direct Potentiometric Determination of Fluoride Species by Using Ion-Selective Fluoride Electrode. International Journal of Electrochemical Science. 7 (2012); 1170-1179. 2. Radić, Njegomir; Prkić, Ante. Historical remarks on the Henderson-Hasselbalch equation: its advantages and limitations and a novel approach for exact pH calculation in buffer region. Reviews in analytical chemistry. 31 (2012); 93-98. 3. Prkić, Ante; Giljanović, Josipa; Petričević, Sandra; Brkljača, Mia; Bralić, Marija. Determination of cadmium, chromium, copper, iron, lead, magnesium, manganese, potassium and zinc in mint tea leaves by electrothermal atomizer atomic absorption spectrometry in samples purchased at local supermarkets and marketplaces. Analytical Letters. 46 (2013), 2; 367-378. 4. Prkić, Ante; Sokol, Vesna; Bošković, Perica. Conductometric Study of Cesium Bromide in Aqueous Butan-2-ol of Lower Mass Fraction. International journal of electrochemical Science, 8 (2013) 4886– 4900. 5. Vukušić, Tina; Prkić, Ante; Giljanović, Josipa; Sokol, Vesna; Bošković, Perica. Direct Potentiometric Determination of Penicillamine in Real Samples by Using Copper ISE. *Croatica Chemica Acta* 2015, 88(3). 255-258. DOI: 10.5562/cca2659
Professional and scholarly articles published in the last five years in subjects of teaching methodology and teaching quality (5 works at most)	
Professional, science and artistic projects in the field of the course carried out in the last five years (5 at most)	
The name of the programme and the volume in which the main teacher passed exams in/acquired the methodological-psychological-didactic-pedagogical group of competences?-pedagoške kompetencije?	Analytical Chemistry (lectures, seminars, exercises)
PRIZES AND AWARDS, STUDENT EVALUATION	
Prizes and awards for teaching and scholarly/artistic work	
Results of student evaluation taken in the last five years for the course that is comparable to the course described in the form (evaluation organizer, average grade, note on grading scale and course evaluated)	

First and last name and title of teacher	PhD, Ani Radonić, associate prof.
The course he/she teaches in the proposed study programme	Synthesis of Biologically Active Compounds
GENERAL INFORMATION ON COURSE TEACHER	
Address	Teslina 10/V, 21000 Split
Telephone number	++385 329 432
E-mail address	radonic@ktf-split.hr
Personal web page	/
Year of birth	1966.
Scientist ID	3119068
Research or art rank, and date of last rank appointment	Research Scientist; March 30th, 2012.
Research-and-teaching, art-and-teaching or teaching rank, and date of last rank appointment	Associate Professor; May 24th, 2012.
Area and field of election into research or art rank	Natural sciences, Chemistry
INFORMATION ON CURRENT EMPLOYMENT	
Institution where employed	Faculty of Chemistry and Technology, University of Split
Date of employment	October 1st, 1992.
Name of position (professor, researcher, associate teacher, etc.)	Associate Professor
Field of research	Natural organic compounds: • Volatile and semi-volatile compounds (essential oils and aroma compounds): monoterpenes, sesquiterpenes, phenylpropanoids; isolation methods; fractionation methods of complex volatile isolates; analysis of volatile isolates by gas chromatography-mass spectrometry (GC-MS). • Glycosidically bound volatile compounds - water-soluble, non-volatile aroma precursors: methods of isolation, purification and hydrolysis (enzymatic, acid); identification of aglycones by GC-MS. • Glucosinolates (thioglucosides) and their degradation products from wild-growing *Brassicaceae* plants: methods of isolation and degradation (thermal degradation, enzymatic degradation); analysis of liberated volatile degradation products by GC-MS. • Evaluation of antioxidant potential of natural products (natural compounds and their mixtures such as different volatile isolates) using different methods: antiradical activity determination method (DPPH assay), total antioxidant activity determination mjethod (FRAP assay), β-carotene bleaching method, thiobarbituric acid method (TBA method) and method for determination of oxidative stability (Rancimat method).
Function	Head of Department of Organic Chemistry (2011. - 2013.; 2013. - 2015.; 2015. -)
INFORMATION ON EDUCATION – Highest degree earned	
Degree	PhD
Institution	Faculty of Chemistry and Technology, University of Split

Place	Split
Date	September 14th, 2005.
INFORMATION ON ADDITIONAL TRAINING	
Year	
Place	
Institution	
Field of training	
MOTHER TONGUE AND FOREIGN LANGUAGES	
Mother tongue	Croatian
Foreign language and command of foreign language on a scale from 2 (sufficient) to 5 (excellent)	English (4)
Foreign language and command of foreign language on a scale from 2 (sufficient) to 5 (excellent)	
Foreign language and command of foreign language on a scale from 2 (sufficient) to 5 (excellent)	
COMPETENCES FOR THE COURSE	
Earlier experience as course teacher of similar courses (name title of course, study programme where it is/was offered, and level of study programme)	1. Undergraduate study of Chemistry: Organic Chemisry I, Organic Chemistry II, Natural Products, Perfumes and Cosmetics 2. Graduate study of Chemistry Synthesis of Biologically Active Compounds 3. Graduate study of Pharmacy: Organic Chemistry I, Organic Chemistry II, Pharmacognosy
Authorship of university/faculty textbooks in the field of the course	I. Jerković, A. Radonić, Praktikum iz organske kemije, Udžbenici Sveučilišta u Splitu, Split, 2009.
Professional, scholarly and artistic articles published in the last five years in the field of the course (5 works at most)	1. I. Jerković, M. Kranjac, Z. Marijanović, M. Zekić, A. Radonić, C. I. G. Tuberoso, Screening of *Satureja subspicata* Vis. Honey by HPLC-DAD, GC-FID/MS and UV/VIS: Prephenate Derivatives as Biomarkers, *Molecules* **21** (2016) 377. 2. I. Jerković, A. Radonić, M. Kranjac, M. Zekić, Z. Marijanović, S. Gudić, M. Kliškić, Red clover (Trifolium pratense L.) honey: Volatiles chemical-profiling and unlocking antioxidant and anticorrosion capacity, *Chem Paper* 70 (2016) in press. 3. I. Jerković, Z. Marijanović, M. Kranjac, A. Radonić, Comparison of Different Methodologies for Detailed Screening of *Taraxacum officinale* Honey Volatiles, *Nat Prod Commun* 10 (2015) 357-360. 4. S. Gudić, E. E. Oguzie, A. Radonić, L. Vrsalović, I. Smoljko, M. Kliškić, Inhibition of copper corrosion in chloride solution by caffeine isolated from black tea, *Maced J Chem Chem En* **33** (2014) 13-25. 5. A. Radonić, I. Blažević, J. Mastelić, M. Zekić, M. Skočibušić, A. Maravić, Phytochemical Analysis and Antimicrobial Activity of *Cardaria draba* L. Desv. volatiles, *Chem. Biodivers*. **8** (2011) 1170-1181.
Professional and scholarly articles	

published in the last five years in subjects of teaching methodology and teaching quality (5 works at most)	
Professional, science and artistic projects in the field of the course carried out in the last five years (5 at most)	• Project HRZZ (IP-11-2013-8547) “Research of Natural Products and Flavours: Chemical Fingerprinting and Unlocking the Potential (NaPro-Flav)” Croatian Science Foundation, 2014. - 2018. • Science project No. 011-0982929-1329: "Essential oils and flavours - biological active compounds and their modifications", Ministry of Science, Education and Sports, Republic of Croatia, 2007. - 2013.
The name of the programme and the volume in which the main teacher passed exams in/acquired the methodological-psychological-didactic-pedagogical group of competences?-pedagoške kompetencije?	
PRIZES AND AWARDS, STUDENT EVALUATION	
Prizes and awards for teaching and scholarly/artistic work	
Results of student evaluation taken in the last five years for the course that is comparable to the course described in the form (evaluation organizer, average grade, note on grading scale and course evaluated)	

First and last name and title of teacher	**PhD, Davor Rušić, prof.**
The course he/she teaches in the proposed study programme	Biochemical engineering (Graduate study of chemistry, course: Organic chemistry and biochemistry; Graduate study of chemical technology, course: Mediterranean cultures)
GENERAL INFORMATION ON COURSE TEACHER	
Address	Ruđera Boškovića 35, 21000 Split
Telephone number	00385 21 329 442
E-mail address	rusic@ktf-split.hr
Personal web page	-
Year of birth	1951
Scientist ID	202886
Research or art rank, and date of last rank appointment	Research adviser (2006)
Research-and-teaching, art-and-teaching or teaching rank, and date of last rank appointment	full professor in permanent position (2011)
Area and field of election into research or art rank	scientific area of technical sciences, scientific filed chemical engineering
INFORMATION ON CURRENT EMPLOYMENT	
Institution where employed	Faculty of Chemistry and Technology, University of Split
Date of employment	1993
Name of position (professor, researcher, associate teacher, etc.)	full professor in permanent position
Field of research	mathematical modelling
Function	full professor in the Department of Chemical Engineering
INFORMATION ON EDUCATION – Highest degree earned	
Degree	Ph. D. in Technical sciences (chemical engineering)
Institution	Faculty of Technology, University of Zagreb
Place	Zagreb
Date	1992
INFORMATION ON ADDITIONAL TRAINING	
Year	
Place	
Institution	
Field of training	

MOTHER TONGUE AND FOREIGN LANGUAGES	
Mother tongue	Croatian
Foreign language and command of foreign language on a scale from 2 (sufficient) to 5 (excellent)	English (4)
Foreign language and command of foreign language on a scale from 2 (sufficient) to 5 (excellent)	French (2)
Foreign language and command of foreign language on a scale from 2 (sufficient) to 5 (excellent)	-
COMPETENCES FOR THE COURSE	
Earlier experience as course teacher of similar courses (name title of course, study programme where it is/was offered, and level of study programme)	• Reaction Engineering (Undergraduate study of chemical engineering) • Biochemical Engineering (Graduate study of chemistry and chemical technology)
Authorship of university/faculty textbooks in the field of the course	• D. Rušić; E. Bacci: Matematički alati-priručnik / Mathematical tools-manual / D. Rušić (ed.), Faculty of Chemistry and Technology, University of Split, Split, 2011. (reviewed and edited teaching materials). • D. Rušić; S. Matešić Slavica: Interaktivna MathCad zbirka zadataka iz reakcijskog inženjerstva/ Interactive Mathcad collection tasks of reaction engineering / D. Rušić (ed.), Faculty of Chemistry and Technology, University of Split, Split, 2011. (reviewed and edited teaching materials).
Professional, scholarly and artistic articles published in the last five years in the field of the course (5 works at most)	• S. Svilović, M. Jakovčević, R. Stipišić, D. Rušić, Equilibrium studies of copper cations exchange by sinthetic zeolite X, *Proceedings of International Conference on Materials, Tribology, Recycling - MATRIB 2013* / Alar, Ž. ; Jakovljević, S. ; Šolić , S. (ur.). Zagreb : Croatian Society for Materials and Tribology, 2013. 368-373. • S. Svilović, I. Piplica, D. Rušić, Adsorption isotherms of cobalt ions emoval using zeolite 13X, *Proceedings of international conference MATRIB 2012,*

	materials/tribology/recycling / Alar, Željko & Jakovljević, Suzana (ur.).Zagreb : Hrvatsko društvo za materijale i tribologiju, 2012. 290-295. • E. Bacci, D. Rušić, S. Svilović, R. Žanetić, matemetičko modeliranje kinetike heterogenih sustava: Modeliranje kinetike reakcijskih sustava koje imaju konverzijsku funkciju s infleksijom, *Proceedings 13th Ružićka Days Today science - tomorrow industry* / Drago Šubarić (ur.), Osijek : Prehrambeno tehnološki fakultet Osijek, Hrvatsko društvo kemijskih inženjera i tehnologa, 2011. 126-136.
Professional and scholarly articles published in the last five years in subjects of teaching methodology and teaching quality (5 works at most)	-
Professional, science and artistic projects in the field of the course carried out in the last five years (5 at most)	• Leader of scientific project 011-0112247-2245: *Chemical engineering in examination of Mari culture,* Ministry of Science, Education and Sports of the Republic of Croatia (January 2, 2007 - December 23, 2014)
The name of the programme and the volume in which the main teacher passed exams in/acquired the methodological-psychological-didactic-pedagogical group of competences?-pedagoške kompetencije?	-
PRIZES AND AWARDS, STUDENT EVALUATION	
Prizes and awards for teaching and scholarly/artistic work	
Results of student evaluation taken in the last five years for the course that is	

comparable to the course described in the form (evaluation organizer, average grade, note on grading scale and course evaluated)	

First and last name and title of teacher	**PhD, Skočibušić Mirjana, associate prof.**
The course he/she teaches in the proposed study programme	General microbiology, Food microbiology
GENERAL INFORMATION ON COURSE TEACHER	
Address	Teslina 12, 21000 Split
Telephone number	021 38 51 33
E-mail address	Mirjana.Skocibusic@pmfst.hr
Personal web page	
Year of birth	1954
Scientist ID	137651
Research or art rank, and date of last rank appointment	*Associate professor*
Research-and-teaching, art-and-teaching or teaching rank, and date of last rank appointment	Natural sciences, field of biology, a branch of microbiology
Area and field of election into research or art rank	Teslina 12, 21000 Split
INFORMATION ON CURRENT EMPLOYMENT	
Institution where employed	1/09/1986.
Date of employment	Professor, researcher
Name of position (professor, researcher, associate teacher, etc.)	Research projects, work with science students-assistants, publications, teaching.
Field of research	Head of the scientific project and manager doctoral studies-Biology
Function	1/09/1986.
INFORMATION ON EDUCATION – Highest degree earned	
Degree	PhD in Natural science, Biology (Microbiology)
Institution	Faculty of Science -University of Zagreb
Place	Zagreb
Date	12/02/1998.
INFORMATION ON ADDITIONAL TRAINING	
Year	
Place	
Institution	
Field of training	
MOTHER TONGUE AND FOREIGN LANGUAGES	
Mother tongue	Croatian
Foreign language and command of foreign language on a scale from 2 (sufficient) to 5 (excellent)	English (4)
Foreign language and command of foreign language on a scale from 2 (sufficient) to 5 (excellent)	French (4)
Foreign language and command of foreign language on a scale from 2 (sufficient) to 5 (excellent)	
COMPETENCES FOR THE COURSE	
Earlier experience as course teacher of similar courses (name title of course, study programme where it is/was offered, and level of study programme)	Microbiology, General Microbiology, Marine Microbiology-undergraduate study of Biology and Chemistry, Special Microbiology - graduate studies in Biology and Chemistry, Bacteria, viruses and subviralni pathogens, Microbial Ecology-Doctoral studies in Education in the field of Natural and Engineering Sciences.
Authorship of university/faculty	

textbooks in the field of the course	
Professional, scholarly and artistic articles published in the last five years in the field of the course (5 works at most)	Maravić, Ana; **Skočibušić, Mirjana**; Šamanić, Ivica; Fredotović, Željana; Cvjetan, Svjetlana; Jutronić, Marinka; Puizina, Jasna. Aeromonas spp. simultaneously harbouring blaCTX-M-15, blaSHV-12, blaPER-1 and blaFOX-2, in wild-growing Mediterranean mussel (*Mytilus galloprovincialis*) from Adriatic Sea, Croatia. ***International Journal of Food Microbiology***. 166 (2013) , 2; 301-308. Maravić, Ana; **Skočibušić, Mirjana**; Šamanić, Ivica; Puizina, Jasna. Profile and multidrug resistance determinants of *Chryseobacterium indologenes* from seawater and marine fauna. ***World journal of microbiology & biotechnology*.** 29 (2013) , 3; 515-522. Odžak, Renata; **Skočibušić, Mirjana**; Maravić, Ana. Synthesis and antimicrobial profile of N-substituted imidazolium oximes and their monoquaternary salts against multidrug resistant bacteria. ***Bioorganic & Medicinal Chemistry*.** 21 (2013) , 23; 7499-7506. Politeo, Olivera; Skočibušić, Mirjana; Burcul, Franko; Maravić, Ana; Carev, Ivana; Ruščić, Mirko; Miloš, Mladen. *Campanula portenschlagiana* Roem. et Schult. : Chemical and Antimicrobial Activities. ***Chemistry & biodiversity*.** 10 (2013) , 6; 1072-1080. Maravić, Ana**; Skočibušić, Mirjana**; Šamanić, Ivica; Puizina, Jasna. Antibiotic susceptibility profiles and first report of TEM extended-spectrum β-lactamase in *Pseudomonas fluorescens* from coastal waters of the Kaštela Bay, Croatia. ***World journal of microbiology & biotechnology*.** 28 (2012) , 5; 2039-2045.
Professional and scholarly articles published in the last five years in subjects of teaching methodology and teaching quality (5 works at most)	
Professional, science and artistic projects in the field of the course carried out in the last five years (5 at most)	Indicators of fecal contamination and possible pathogens in coastal areas (177-0000000-3182) 2008 – 2013.
The name of the programme and the volume in which the main teacher passed exams in/acquired the methodological-psychological-didactic-pedagogical group of competences?-pedagoške kompetencije?	The complete graduate studies of Biology - Professor of Biology
PRIZES AND AWARDS, STUDENT EVALUATION	
Prizes and awards for teaching and scholarly/artistic work	
Results of student evaluation taken in the last five years for the course that is comparable to the course described in the form (evaluation organizer, average grade, note on	Regular surveys of quality of teaching which is carried out by the University of Split. Ratings have been very positive.

grading scale and course evaluated)	

First and last name and title of teacher	**PhD, Vesna Sokol, associate prof.**
The course he/she teaches in the proposed study programme	Physical Chemistry of Electrolyte Solutions Colloid Chemistry Microemulsions in Applied Chemistry
GENERAL INFORMATION ON COURSE TEACHER	
Address	Ruđer Bošković 35, 21 000 Split
Telephone number	021-329-445
E-mail address	vsokol@ktf-split.hr
Personal web page	
Year of birth	1968.
Scientist ID	212806
Research or art rank, and date of last rank appointment	Senior Research Associate, 2014.
Research-and-teaching, art-and-teaching or teaching rank, and date of last rank appointment	Associate Professor, 2015.
Area and field of election into research or art rank	Natural Sciences, Chemistry, Physical Chemistry
INFORMATION ON CURRENT EMPLOYMENT	
Institution where employed	Faculty of Chemistry and Technology, University of Split
Date of employment	1. 8. 1996.
Name of position (professor, researcher, associate teacher, etc.)	Associate Professor
Field of research	1. Thermodynamics of various ionic reactions in mixed solvents 2. Classical microemulsion systems and surfactant-free microemulsions 3. Application of ion sensors for the determination of different analytes
Function	Head of Department
INFORMATION ON EDUCATION – Highest degree earned	
Degree	Ph.D.
Institution	Faculty of Chemistry and Technology, University of Split
Place	Split
Date	31. 10. 2006.
INFORMATION ON ADDITIONAL TRAINING	
Year	2007.
Place	Rijeka
Institution	University of Rijeka
Field of training	Synchrotron radiation
MOTHER TONGUE AND FOREIGN LANGUAGES	
Mother tongue	Croatian
Foreign language and command of foreign language on a scale from 2 (sufficient) to 5 (excellent)	English, very good
Foreign language and command of foreign language on a scale from 2 (sufficient) to 5 (excellent)	
Foreign language and command of foreign language on a scale from 2 (sufficient) to 5 (excellent)	
COMPETENCES FOR THE COURSE	
Earlier experience as course teacher of similar courses (name title of course, study programme	Physical Chemistry I, Undergraduated study of chemistry Physical Chemistry, Undergraduated study of chemical technology

where it is/was offered, and level of study programme)	Physical Chemistry of Electrolyte Solutions, Graduated study of chemistry Colloid Chemistry, Graduated study of chemistry
Authorship of university/faculty textbooks in the field of the course	V. Sokol, P. Bošković, Exercises in Colloid Chemistry, Faculty of Chemistry and Technology, Split, 2016.
Professional, scholarly and artistic articles published in the last five years in the field of the course (5 works at most)	1. Bošković, P.; Sokol, V.; Touraud, D.; Prkić, A.; Giljanović, J., The Nanostructure Studies of Surfactant-Free-Microemulsions in Fragrance Tinctures. // Acta chimica Slovenica. 63 (2016) 1; 138-143. 2. Bošković, P.; Sokol, V.; Zemb, T.; Touraud, D.; Kunz, W., Weak Micelle-Like Aggregation in Ternary Liquid Mixtures as Revealed by Conductivity, Surface Tension and Light Scattering. // The journal of physical chemistry. B, Condensed matter, materials, surfaces, interfaces & biophysical. 119 (2015) 30; 9933-9939. 3. Tranfić Bakić, M.; Jadreško, D.; Hrenar, T.; Horvat, G.; Požar, J.; Galić, N.; Sokol, V.; Tomaš, R.; Alihodžić, S.; Žinić, M.; Frkanec, L.; Tomišić, V., Fluorescent phenanthridine-based calix[4]arene derivatives: synthesis and thermodynamic and computational studies of their complexation with alkali-metal cations. // RSC Advances. 5 (2015) 30; 23900-23914. 4. Vukušić, T.; Prkić, A.; Giljanović, J.; Sokol, V.; Bošković, P., Direct Potentiometric Determination of Penicillamine in Real Samples by Using Copper ISE. // Croatica chemica acta. 88 (2015) 3; 255-258. 5. Bošković, P.; Sokol, V.; Prkić, A.; Giljanović, J., Conductometric Study of Sodium Chloride in Aqueous 2-methylpropan-2-ol of Mass Fraction 0.10, 0.30, 0.50, 0.70, 0.80 and 0.90. // International journal of electrochemical science. 9 (2014) 7; 3574-3587.
Professional and scholarly articles published in the last five years in subjects of teaching methodology and teaching quality (5 works at most)	
Professional, science and artistic projects in the field of the course carried out in the last five years (5 at most)	Scientific project 011-0000000-3220: " Electrolytes in mixed solvents ", the Ministry of Science, Education and Sports
The name of the programme and the volume in which the main teacher passed exams in/acquired the methodological-psychological-didactic-pedagogical group of competences?-pedagoške kompetencije?	
PRIZES AND AWARDS, STUDENT EVALUATION	
Prizes and awards for teaching and scholarly/artistic work	
Results of student evaluation taken in the last five years for the course that is comparable to the course described in the form (evaluation organizer, average grade, note on grading scale and course	

evaluated)	

3.4. Optimal number of students

The optimal number of students at the Undergraduate study who can be enrolled in one year of study in terms of space, equipment and number of full-time teachers is 40 (this represents the enrollment quota).

3.5. Estimate of costs per student

Average annual cost of studying per one student is aproximately 31,500.00 kunas.

3.6. Plan of procedures of study programme quality assurance

In keeping with the European standards and guidelines for internal quality assurance in higher education institutions (according to "Standards and Guidelines of Quality Assurance in the European Higher Education Area") on the basis of which the University of Zagreb defines procedures for quality assurance, the proposer of the study programme is obliged to draw up a plan of procedures of study programme quality assurance.	
Documentation on which the quality assurance system of the constituent part of the University is based:	
• Regulations on the quality assurance system of the constituent part (enclose if existing)	
• Handbook on the quality assurance system of the constituent part (enclose if it exists)	
Description of procedures for evaluation of the quality of study programme implementation: • Fore each procedure the method needs to be described (most often questionnaires for students or teachers, and self-evaluation questionnaire), name the body conducting evaluation (constituent part, university office), method of processing results and making information available, and timeframe for carrying out evaluation • If procedure is described in an attached document, name the document and the article.	
Evaluation of the work of teachers and part-time teachers	The process of student evaluation of the teaching quality is conducted by the Quality Enhancement Centre (at the level of the University) and the Quality Enhancement Committees (at the level of constituents). The procedure consists of informing students and teachers, student survey questionnaire, the processing of the questionnaires and reporting on the results, the adoption of measures to improve quality. The procedure is described in detail in the Regulations on the procedure for student evaluation of teaching *at the University of Split*. The processing of the questionnaires and reporting on the results are under jurisdiction of the Quality Enhancement Centre. Summary results for the each constituent are submitted to the Dean and the leader of the Quality Enhancement Committee.
Monitoring of grading and	Procedures, rules and criteria for grading of students

harmonization of grading with anticipated learning outcomes	include: method for taking the exams, requirements for taking the exams, method of evaluation through colloquia, seminars, active participation in classes, exams and other obligations, conditions for signature, a list of references for exam preparation, and data about the teacher, assistant, etc. Informations about procedures, rules and criteria for grading students can found on the website of the Faculty and at the introductory lectures.
Evaluation of availability of resources (spatial, human, IT) in the process of learning and instruction	The Faculty provides adequate and appropriate educational resources for the study program and support for teaching and non-teaching activities of students, which are consistent with the specific programs and student needs and readily accessible to students (equipped classrooms, library, computer classrooms, and support for students with disabilities.
Availability and evaluation of student support (mentorship, tutorship, advising)	Student evaluation of the teaching quality, student survey questionnaire.
Monitoring of student pass/fail rate by course and study programme as a whole	Analysis of student success at the study is conducted by Quality Enhancement Centre of the University of Split. The analysis is carried annually by survey questionnaire at the beginning of the academic year for the previous academic year. The results of the analysis and measures to improve student success are presented to the Senate of the University of Split by leader of the Quality Enhancement Centre. Likewise, ISVU system allows the student service and ISVU coordinator to keep track of student pass/fail rate by course and study programme as a whole.
Student satisfaction with the programme as a whole	Quality Improvement Centre of the University of Split has defined the procedure for conducting a survey on the evaluation of the overall study. The student survey questionnaire for evaluation of the study is conducted by the platform Evasys but after the student has passed the final exam. The aim of the survey is to hear the opinion of students on various aspects of the study which they have completed and to determine flaws in order to increase the quality of the content and implementation of the study. Data is conducted by Quality Enhancement Centre and results are submitted to the Head of Department and to leader of the Quality Enhancement Centre.
Procedures for obtaining feedback from external parties (alums, employers, labour market and other relevant organizations)	Former students are contacted in order to express their assessment of the qualifications for the professional requirements. Selected employers can be contacted as well in order to assess their satisfaction with students which have been studing at this the study program. Regular exchange of information at conferences organized by the ALUMNI of the Faculty (AMACTFS).
Evaluation of student practical	Evaluation of student training is conducted orally by the

education (where this applies)	course teacher. At the same time the student must submit the log and seminar about selected topic of professional practice.
Other evaluation procedures carried out by the proposer	Formal and informal consultation with colleagues in the profession at the Faculty level and beyond.
Description of procedures for informing external parties on the study programme (students, employers, alums)	Results are available on the official web site of the Faculty (https://www.ktf.unist.hr) Brochure (revised annually) The University review. Universitas – supplement of the Slobodna Dalmacija about the University of Split. The participation of staff and students ot the Faculty at the Science Festival and similar events.