
**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 CHEMICAL TECHNOLOGY

SPLIT, June 2016.

# GENERAL INFORMATION OF HIGHER EDUCATION INSTITUTION

| | |
|---|---|
| Name of higher education institution | Faculty of Chemistry and Technology |
| Address | Ruđera Boškovića 35 |
| Phone | ++ 385 21 329 420 |
| Fax | ++ 385 21 329 461 |
| E-mail | dekanat@ktf-split.hr |
| Internet address | https://www.ktf.unist.hr/ |

# GENERAL INFORMATION OF THE STUDY PROGRAMME

| | | | |
|---|---|---|---|
| Name of the study programme | Graduate Study of Chemical Technology | | |
| 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 Engineer of Chemical Engineering | | |

# 1. INTRODUCTION

## 1.1. Reasons for starting the study programme

By the graduate study of chemical technology**,** the Faculty of Chemical Technology of Split, as a high-education and scientific institution, is trying to offer a new impetus for economic development and rational economizing on natural resources. This study provides knowledge required for designing, leading and developing of sustainable chemical processes, as well as the knowledge on the methods of quality investigations and their development at the process of analysis. The graduate study is organized through three study orintations: Materials, Environmental Protection and Chemistry and Technology of Mediterranean Cultures. The basic knowledge from the field of chemical engineering is applied in the manufacture and analysis of materials, in the investigations of various degradation processes and in the protection of construction materials in different surroundings. Sustainable development is closely connected with industry and environment. When they finish this study, the students can be quickly involved in work to solve many problems and promote the interrelation between technological development and environment, with an emphasis on water resources and coastal sea, and on soil and atmosphere protection.

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

The proposed study programs are based on the scientific knowledge of chemistry, chemical engineering and food technology, which significantly contributes to modern education of new experts. The possible partners outside high-school education system interested in continuation of the study of chemical technology are the economy and public services of the Split-Dalmatia County, as well as: cement industry, shipbuilding industry, processing of polymer materials, Institute for Oceanography and Fishing, Croatian Hydrographical Institute, Institute for Adriatic Cultures and Melioration of Karsts, Institute for Civil Engineering, Public Health Institute and other County and City public services. It is important to point out that due to the geographic position of Split there is a growing presence of students not only from Dalmatia but also from Bosnia and Herzegovina, so that such a trend is expected to continue in the future.

## 1.3. Compatibility with requirements of professional organizations

One of the basic assumptions for quality implementation of the proposed program is educational, professional and research cooperation of all relevant factors that may contribute to the process of the training and education of students. The teachers who teach at the graduate study of chemical technology are members of various professional associations and commitie (Croatian Society of Chemical Engineers, Association of Chemical Engineers Split, Croatian Chemical Society Parent Committee for Technical Sciences, Chemical Engineering field, Croatian Academy of Engineering , Croatian standard Institute, etc.).

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

The possible partners outside high-school education system interested in continuation of the study of chemical technology are the economy and public services of the Split-Dalmatia County and beyond. Some of the specialized sites and laboratories with whom Faculty cooperates (usually for the purpose of student's practical and field work and the preparation of graduate theses of students) are: companies from Dalmatia (eg. AD Plastik, Brodosplit, CEMEX, Cian), the entire Croatia (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. Aluminij Mostar). Faculty partners are also institutes as follows: Institute Ruđer Bošković, Institute for Adriatic Crops and Karst Reclamation, Institute of Oceanography and Fisheries.

## 1.5. Financing

The planned source of financing for the graduate study of chemical technology is the Ministry of Science, Education and Sports.

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

When elaborating the programs, special care was taken to harmonize the subjects and their teaching programs with related studies at other high-school institutions. In that way the programmes are mutually comparable and, also, they stimulate the student and teacher mobility. The proposed program can be compared with the programmes of the following high-school institutions:

- Politecnico di Torino, Italy (www.polito.it )
- University of Maribor, Slovenia (http://www.fkkt.uni-lj.si),
- University of Pardubice, Czech Republic (http://www.upce.cz/en/fcht/uechi.html),
- Politechnika Warszawska, Poland (http://www.ichip.pw.edu.pl/)
- Università degli Studi di Roma "La Sapienza" ( http://www.chem.uniroma1.it/didattica/offerta-formativa/cdl-chimica-industriale), Rome, Italy;
- Universidad Rey Juan Carlos, Madrid, Spain.

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

It can be realized through the enrolment of particular subjects in other university studies, as well as of the whole semesters in the related studies, or through the work on the final project. The students will be also given an opportunity to enroll in a certain number of courses out of their profession. The studies suitable for the realization of that mobility are the components of the University of Split, but also of other Croatian universities and high-school institutions of the EU countries. The study programme is organized in one-semester courses, which is one of the important prerequisites of student mobility. The proposed programme of graduate study of chemical technology and its comparability with the related studies in the Republic of Croatia and the EU countries enables the student and teacher mobility. The mobility can be realized through the enrolment

of particular subjects in other university studies, as well as of the whole semesters in the related studies, or through the work on the final project. Institutions with which it will be possible to achieve the mobility are constituents of the University of Split, other Croatian universities (Faculty of Chemical Engineering and Technology in Zagreb, Faculty of Food Technology in Zagreb, Faculty of Food Technology in Osijek, Faculty of Textile Technology in Zagreb, Faculty of Graphic Arts in Zagreb, etc.), and certain institutions from the European Union. The Faculty has signed the agreement for Erasmus mobility of teachers and students with the Universite Techniche Dresden, Dresden, Germany, Universita degli Studi di Cagliari, Cagliari, Italy, Universita di Trieste, Trieste, Italy, AGH University of Science and Technology, Krakow, Polonia, Polytecnich institutes of Braganca, Braganca, Portugal, University of Maribor, Maribor, Slovenia, Polymer technology college, Maribor, Slovenia and others. The Faculty also participates 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 is achived: 1) Faculty of Material Science and Ceramics, AGH University of Science and Technology, Kraków, 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

The study program has been consolidated with the Strategy of the development of the Faculty, its mission and vision, as well with the strategy of the University of Split.

### 1.9. Current experiences in equivalent or similar study programmes

The Faculty of Chemical Technology of Split was founded in 1960, responding the economic demands of the region and aiming at fulfilling its personnel and professional needs. On the grounds of the acquired scientific knowledge and economic demands, the teaching programs have been continually improved and up-dated. Close cooperation between this region economy and the Faculty has resulted in great number of projects, expertise, elaborates and, in particular, in opening new study orientations and post graduate studies, the content of which is just the result of this region needs.

# 2. DESCRIPTION OF THE STUDY PROGRAMME

### 2.1. General information

| | |
|---|---|
| Scientific/artistic area of the study programme | Technical 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 appropriate undergraduate study |

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

Master engineer of chemical engineering generally will be able to:
- apply statistical and mathematical analysis in chemical engineering experiments and processes
- tackle a real chemical engineering problem by a scientific approach
- recognise the need for information, find and provide information
- plan and carry out both theoretical and experimental researcheas independently
- evaluate data critically and draw conclusions from it
- apply basic methodology of chemical engineering necessary in the selection of an appropriate processes and devices
- define and optimize the process parameters to increase process efficiency
- adopt a methodological approach in device designing that are used in process engineering
- think systematically about the non-technical effects of an engineer's job and include these aspects responsibly in what they do
- function effectively as a member of a team that may be composed of different disciplines and levels
- work and communicate effectively in national and international contexts,

and specifically, depends on orientation:

- apply innovative methods in solving problems in materials development and environmental protection based on fundamental principles of chemistry and thermodynamics
- apply basic chemical engineering methodology necessary for processes and equipment selection used in production of materials and environmental protection in order to elevate the process effectiveness
- methodically develop the equipment used in process engineering
- analyse and solve problems concerning polymers production, processing or characterization
- analyse and solve problems concerning properties of construction materials and their protection against corrosion
- analyse and solve problems concerning environmental protection during materials processing
- classify knowledge from various fields methodically such as materials, corrosion and environmental protection and draw systematic conclusions from it
- apply engineering skills to conduct the processes and solve the problems in food processing characteristic for Mediterranean region.

## 2.3. Employment possibilities

Graduates can be employed by the aforementioned business entities with which the faculty cooperates, as well at educational institutions, various inspection services at the national and regional level, etc. Employment opportunities in the region:
- Brodosplit, Split

- AD plastik, Split
- Omial, Omiš
- Cemex, Kaštel Sućurac
- Adriacink, Split
- Vodovod i kanalizacija, Split
- TOF, Drniš
- ALPRO ATT, Trogir...

## 2.4. Possibilities of continuing studies at a higher level

Higher level studies are possible at the postgraduate studies of Chemical Engineering in Materials Development and Environmental Protection and Chemistry of Mediterranean Environment at Faculty of Chemistry and Technology and at others institutes in Croatia and abroad as well.

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

The permission to qualify for admission to the proposed study have candidates who have completed undergraduate studies at the Faculty of Chemical Technology of Split at the University of Split, undergraduate programs of the Faculty of Chemical Engineering and Technology at the University of Zagreb, undergraduate study of Food Technology and Biotechnology at the Faculty of Food Technology in Zagreb, undergraduate study of Chemistry at the Josip Juraj Strossmayer University in Osijek and undergraduate study of Food technology at Faculty of Food Technology at the Josip Juraj Strossmayer University in Osijek.

## 2.6. Structure of the study

Conditions and modes of studying at Graduate Study of Chemical Technology are based on the Ordinance on study programmes and course attendance system at the Faculty of Chemistry and Technology in Split which is in compliance with the Ordinance on study programmes and course attendance system at the University of Split. Graduate Study of Chemical Technology takes place during the two years, includes mandatory and elective courses, and it is based on active participation of students in all forms of studing (lectures, laboratory exercises, seminars, field trips, etc.). In general, students' obligations include presence at lectures and exercises, independent learning, literature analysis, presentations, field work and the preparation and defense of the diploma thesis. The monitoring and evaluating student's activities listed in the program are done by teachers. During the first year of study objective is focused on mastering basic knowledge of chemistry and related natural sciences, respectively. During the last three semesters of study the content of chemical engineering is gradually increased. In the final semester students have the option of choosing from a large number of elective courses. The study ends with the preparation and defense of the diploma thesis.

## 2.7. Guiding and tutoring through the study system

With the aim of providing advice, information and guidance to students during the course of study, the Faculty Council of Faculty of Chemistry and Technology appoints the head of study for student groups at each year of study

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

With the aim of continuing and extending their education, and strengthening and supporting professional training, especially in the context of raising awareness on the interrelation between faculties and universities, students may take elective courses from other study programmes that offer courses that relate or overlap with the topic of interest of this study programme. The procedure for selecting courses from other faculties is defined in the Ordinance on study programmes and course attendance system at the Faculty of Chemistry and Technology in Split.

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

As a rule, the lectures and courses held at the study programme Protection and Recycling of Materials shall be provided in Croatian language. Since there are courses included in the programme that are proposed to be taught in English, as necessary these courses will be provided in English.

## 2.10. Criteria and conditions for transferring the ECTS credits

The criteria and requirements for the transfer of ECTS credits are regulated by the Ordinance on study programmes and course attendance system at the University of Split, Statute of the Faculty of Chemistry and Technology in Split and Ordinance on study programmes and course attendance system at the Faculty of Chemistry and Technology in Split.

## 2.11. Completion of study

| | | |
|---|---|---|
| *Final requirement for completion of study* | Final thesis ☐<br>Diploma thesis ☒ | Final exam ☐<br>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

**Materials**

| List of courses | | | | | | | |
|---|---|---|---|---|---|---|---|
| Year of study: 1st | | | | | | | |
| Semester: 1st | | | | | | | |
| STATUS | CODE | COURSE | HOURS IN SEMESTER | | | | ECTS |
| | | | L | S | E | F | |
| Mandatory | KTB101 | Applied Mathematics | 30 | 15 | 0 | 0 | 4.0 |
| | KTB102 | Thermodynamics of Real Processes | 30 | 15 | 30 | 0 | 6.5 |
| | KTB103 | Instrumental Methods of Analysis | 30 | 15 | 30 | 0 | 6.5 |
| | KTB104 | Process Automatic Regulation | 30 | 15 | 30 | 0 | 6.5 |
| | KTB105 | Mechanical and Thermal Processes | 30 | 15 | 30 | 0 | 6.5 |
| | Total | | 150 | 75 | 120 | 0 | 30 |

| List of courses | | | | | | | |
|---|---|---|---|---|---|---|---|
| Year of study: 1st | | | | | | | |
| Semester: 2nd | | | | | | | |
| STATUS | CODE | COURSE | HOURS IN SEMESTER | | | | ECTS |
| | | | L | S | E | F | |
| Mandatory | KTB106 | Chemical Reactors | 30 | 15 | 15 | 0 | 5.0 |
| | KTB107 | Electrochemical Engineering | 30 | 30 | 30 | 0 | 6.5 |
| | KTB108 | Inorganic Processes in Heterogeneous Systems | 45 | 15 | 45 | 0 | 8.0 |
| | KTB109 | Polymerization Processes | 45 | 15 | 45 | 0 | 8.0 |
| | KTBOSP | Professional Practice | | | | | 2.5 |
| | Total | | 150 | 75 | 135 | 0 | 30 |

| List of courses | | | | | | | |
|---|---|---|---|---|---|---|---|
| Year of study: 2nd | | | | | | | |
| Semester: 3rd | | | | | | | |
| STATUS | CODE | COURSE | HOURS IN SEMESTER | | | | ECTS |
| | | | L | S | E | F | |
| Elective | | **Elective courses of group: Organic Materials** | | | | | |
| | KTB201 | Structure and Properties of Polymers | 30 | 0 | 30 | 0 | 5.0 |
| | KTB202 | Polymers Characterization | 30 | 0 | 30 | 0 | 5.0 |
| | KTB224 | Polymer Blends and Composites | 30 | 0 | 30 | 0 | 5.0 |
| | KTB204 | Polymer Processing | 30 | 0 | 30 | 0 | 5.0 |
| | KTB206 | Coatings | 30 | 0 | 30 | 0 | 5.0 |
| | | **Elective courses of group: Inorganic Materials** | | | | | |
| | KTB207 | Glass and Ceramics | 30 | 0 | 30 | 0 | 5.0 |
| | KTB208 | New Inorganic Materials | 30 | 0 | 30 | 0 | 5.0 |
| | KTB209 | Technology of Building Materials | 30 | 0 | 30 | 0 | 5.0 |
| | KTB210 | Non-metallic Composites | 30 | 0 | 30 | 0 | 5.0 |
| | KTB211 | Structure and Properties of Inorganic Non-metallic Materials | 30 | 0 | 30 | 0 | 5.0 |
| | KTB212 | Corrosion and Degradation of Building Materials | 30 | 0 | 30 | 0 | 5.0 |
| | | **Elective courses of group: Materials Protection** | | | | | |
| | KTB213 | Corrosion and Materials Protection | 30 | 0 | 30 | 0 | 5.0 |
| | KTB214 | Electrodeposition Processes | 30 | 0 | 30 | 0 | 5.0 |
| | KTB215 | Surface Protection Technologies | 30 | 0 | 30 | 0 | 5.0 |
| | KTB216 | Electrochemical Methods and Their Application | 30 | 0 | 30 | 0 | 5.0 |
| | KTB217 | Corrosion Inhibitors | 30 | 0 | 30 | 0 | 5.0 |
| | KTB221 | Solid Waste Recycling | 30 | 0 | 30 | 0 | 5.0 |
| | The minimum amount of credits that must be obtained from elective courses is 30, at least two courses from each group. | | | | | | |

| List of courses | | | | | | | |
|---|---|---|---|---|---|---|---|
| Year of study: 2nd | | | | | | | |
| Semester: 4th | | | | | | | |
| STATUS | CODE | COURSE | HOURS IN SEMESTER | | | | ECTS |
| | | | L | S | E | F | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Mandatory | KTB219 | Process Design | 30 | 30 | 0 | 0 | 7.0 |
| | KTBODR | Diploma Thesis | | | | | 18.0 |
| | Total | | | | | | 25.0 |
| Elective | KTB220 | Marine and Submarine Mineral Raw Materials | 30 | 0 | 30 | 0 | 5.0 |
| | KTB218 | Direct Energy Conversion | 30 | 0 | 30 | 0 | 5.0 |
| | KTB225 | Wastewater Engineering | 30 | 0 | 30 | 0 | 5.0 |
| | KTB205 | Naturally Occurring Polymeric Materials | 30 | 0 | 30 | 0 | 5.0 |
| | KTB226 | Introduction to Scientific Research | 15 | 15 | 0 | 0 | 2.0 |
| | The minimum amount of credits that must be obtained from elective courses is 5.0. | | | | | | |

**Environmental Protection**

| List of courses | | | | | | | |
|---|---|---|---|---|---|---|---|
| Year of study: 1st | | | | | | | |
| Semester: 1st | | | | | | | |
| STATUS | CODE | COURSE | HOURS IN SEMESTER | | | | ECTS |
| | | | L | S | E | F | |
| Mandatory | KTB101 | Applied Mathematics | 30 | 15 | 0 | 0 | 4.0 |
| | KTB102 | Thermodynamics of Real Processes | 30 | 15 | 30 | 0 | 6.5 |
| | KTC107 | Catalysis in Environmental Protection | 30 | 15 | 0 | 0 | 4.5 |
| | KTC108 | Electrochemical Technologies in Environmental Protection | 30 | 15 | 15 | 0 | 5.0 |
| | KTC109 | Measurment and Automatic Process Control | 30 | 0 | 8 | 7 | 4.0 |
| | KTC110 | Biochemistry | 30 | 15 | 30 | 0 | 7.0 |
| | Total | | 180 | 75 | 83 | 7 | 30 |

| List of courses | | | | | | | |
|---|---|---|---|---|---|---|---|
| Year of study: 1st | | | | | | | |
| Semester: 2nd | | | | | | | |
| STATUS | CODE | COURSE | HOURS IN SEMESTER | | | | ECTS |
| | | | L | S | E | F | |
| Mandatory | KTB 106 | Chemical Reactors | 30 | 15 | 15 | 0 | 5.0 |
| | KTC106 | Environmental Process Engineering | 45 | 15 | 15 | 15 | 7.0 |
| | KTC111 | Sustainable Technologies and Development | 30 | 15 | 0 | 0 | 4.5 |
| | KTC 112 | Methods for Characterization of Materials | 30 | 0 | 30 | 0 | 5.0 |
| | KTC 113 | Environmetal Remediation Technologies | 30 | 15 | 15 | 0 | 5.0 |
| | KTCOSP | Professional Practice | | | | | 2.5 |
| | Total | | 165 | 60 | 75 | 15 | 29 |

| List of courses | | | | | | | |
|---|---|---|---|---|---|---|---|
| Year of study: 2nd | | | | | | | |
| Semester: 3rd | | | | | | | |
| STATUS | CODE | COURSE | HOURS IN SEMESTER | | | | ECTS |
| | | | L | S | E | F | |
| Mandatory | KTC 218 | Advanced water treatment engineering | 30 | 15 | 30 | 0 | 7.0 |
| | KTC 219 | Solid Waste Recycling | 30 | 0 | 0 | 0 | 3.0 |
| | Total | | 60 | 15 | 60 | 0 | 11.5 |
| Elective | KTC 206 | Microbiology of Polluted Waters | 30 | 15 | 15 | 0 | 5.0 |
| | KTC 211 | Ecotoxicology | 30 | 0 | 30 | 0 | 5.0 |
| | KTC 212 | Soil Chemistry | 30 | 15 | 15 | 0 | 5.0 |
| | KTC 215 | Recycling of Plastics | 30 | 0 | 25 | 5 | 5.0 |
| | KTC 216 | Nanotechnology and the Environment | 30 | 15 | 0 | 0 | 4.5 |
| | KTC 220 | Product Life Cycle Assessment (LCA) | 30 | 15 | 0 | 0 | 4.5 |
| | KTC 221 | Study on the Environmental Impact | 30 | 30 | 0 | 0 | 5.0 |
| | KTB 212 | Corrosion and Degradation of Building Materials | 30 | 0 | 20 | 10 | 5.0 |
| | KTB 215 | Surface Protection Technologies | 30 | 0 | 25 | 5 | 5.0 |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | The minimum amount of credits that must be obtained from elective courses is 18.5, at least one from each group. | | | | | | |

| List of courses | | | | | | | |
|---|---|---|---|---|---|---|---|
| Year of study: 2nd | | | | | | | |
| Semester: 4th | | | | | | | |
| STATUS | CODE | COURSE | HOURS IN SEMESTER | | | | ECTS |
| | | | L | S | E | F | |
| Mandatory | KTC217 | Energy and Development | 30 | 0 | 0 | 0 | 3.0 |
| | KTB219 | Process Design | 30 | 30 | 0 | 0 | 7.0 |
| | KTCODR | Diploma Thesis | | | | | 18.0 |
| | Total | | 60 | 30 | 0 | 0 | 28.0 |
| Elective | KTC 222 | Sanitary Landfill Disposal | 30 | 15 | 0 | 15 | 5.0 |
| | KTC 223 | Chemical Ecology | 30 | 15 | 15 | 0 | 5.0 |
| | KTB 220 | Marine and Submarine Mineral Raw Materials | 30 | 0 | 30 | 0 | 5.0 |
| | KTB 226 | Introduction to Scientific Research | 15 | 15 | 0 | 0 | 3.0 |
| | The minimum amount of credits that must be obtained from elective courses, among those offered in third semester, is 2.0. | | | | | | |

**Mediteranean Cultures**

| List of courses | | | | | | | |
|---|---|---|---|---|---|---|---|
| Year of study: 1st | | | | | | | |
| Semester: 1st | | | | | | | |
| STATUS | CODE | COURSE | HOURS IN SEMESTER | | | | ECTS |
| | | | L | S | E | F | |
| Mandatory | KTD 109 | General Biology | 30 | 0 | 15 | 0 | 4.0 |
| | KTC110 | Biochemistry | 30 | 15 | 30 | 0 | 7.0 |
| | KTD106 | Hygiene and Sanitation | 30 | 15 | 15 | 0 | 6.0 |
| | KTD107 | Biochemical Engineering | 30 | 0 | 15 | 0 | 5.0 |
| | KTD103 | Processes in Food Industry | 30 | 15 | 30 | 0 | 6.0 |
| | Total | | **150** | **45** | **105** | **0** | **28.0** |

| List of courses | | | | | | | |
|---|---|---|---|---|---|---|---|
| Year of study: 1st | | | | | | | |
| Semester: 2nd | | | | | | | |
| STATUS | CODE | COURSE | HOURS IN SEMESTER | | | | ECTS |
| | | | L | S | E | F | |
| Mandatory | KTD108 | General Microbiology | 30 | 0 | 30 | 0 | 4.0 |
| | KTD101 | Water Technology | 30 | 15 | 30 | 0 | 5.5 |
| | KTD102 | Biotechnological Processes | 30 | 15 | 30 | 0 | 5.5 |
| | KTD105 | Fruit and Vegetable Processing | 45 | 15 | 30 | 0 | 8.0 |
| | KTH106 | Chemistry and Technology of Aromatic Plants | 30 | 15 | 30 | 0 | 6.5 |
| | KTDOSP | Professional Practice | 10 days | | | | 2.5 |
| | Total | | **165** | **60** | **150** | **0** | **32.0** |

| List of courses | | | | |
|---|---|---|---|---|
| Year of study: 2nd | | | | |
| Semester: 3rd | | | | |
| STATUS | CODE | COURSE | HOURS IN SEMESTER | ECTS |

| | | | L | S | E | F | |
|---|---|---|---|---|---|---|---|
| Mandatory | KTD201 | Grape Processing | 45 | 15 | 30 | 0 | 8.0 |
| | KTD215 | Processing of Olives | 45 | 0 | 30 | 0 | 7.0 |
| | KTD203 | Quality Assurance of Food | 30 | 0 | 30 | 0 | 4.0 |
| | Total | | **120** | **15** | **90** | **0** | **19.0** |
| Elective | KTD204 | Citrus Processing | 30 | 0 | 15 | 0 | 4.0 |
| | KTD205 | Mediterranean Diet | 30 | 0 | 15 | 0 | 4.0 |
| | KTD217 | Seafood processing and quality | 30 | 0 | 15 | 0 | 4.0 |
| | KTD208 | Instrumental Methods of Analysis | 30 | 0 | 15 | 0 | 4.0 |
| | KTD209 | Corrosion and Materials Protection | 30 | 0 | 15 | 0 | 4.0 |
| | KTD210 | Separation processes | 30 | 0 | 15 | 0 | 4.0 |
| | KTD211 | Perfumes and Cosmetics | 30 | 0 | 15 | 0 | 4.0 |
| | KTD212 | Physical Biochemistry | 30 | 0 | 15 | 0 | 4.0 |
| | KTD213 | Applied Mathematics | 30 | 15 | 0 | 0 | 4.0 |
| | Total sum of elective courses must be 12 ECTS. | | | | | | |

| **List of courses** | | | | | | | |
|---|---|---|---|---|---|---|---|
| Year of study: 2nd | | | | | | | |
| Semester: 4th | | | | | | | |
| STATUS | CODE | COURSE | HOURS IN SEMESTER | | | | ECTS |
| | | | L | S | E | F | |
| Mandatory | KTD216 | Packaging | 30 | 0 | 30 | 0 | 4.0 |
| | KTB219 | Process Design | 30 | 30 | 0 | 0 | 7.0 |
| | KTDODR | Diploma Thesis | | | | | 18.0 |
| | | | | | | | |
| | Total | | **60** | **30** | **30** | **0** | **29.0** |

## 2.13. Course description

# Applied Mathematics

<table>
<tr><td colspan="2">NAME OF THE COURSE</td><td colspan="5">Applied Mathematics</td></tr>
<tr><td>Code</td><td>KTB101</td><td>Year of study</td><td colspan="4">4th</td></tr>
<tr><td>Course teacher</td><td>Nives Baranović, lecturer</td><td>Credits (ECTS)</td><td colspan="4">4.0</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></td><td></td></tr>
<tr><td>Status of the course</td><td>Mandatory</td><td>Percentage of application of e-learning</td><td colspan="4">20%</td></tr>
<tr><td colspan="7">COURSE DESCRIPTION</td></tr>
<tr><td>Course objectives</td><td colspan="6">Student are introduced to the ideas and methods of approximate solving algebraic and differential equations, interpolation and numerical integration, to concepts of the theory of probability and statistics and their application to particular example and tasks.<br>By developing a positive attitude toward learning, responsibility for own success and progress, and the acquisition of competencies described above, the students are expected to build a solid foundation for lifelong learning and further education.</td></tr>
<tr><td>Course enrolment requirements and entry competences required for the course</td><td colspan="6">Students should have fundamental competencies related to the calculus.</td></tr>
<tr><td>Learning outcomes expected at the level of the course (4 to 10 learning outcomes)</td><td colspan="6">After the passing the exam, students will be able to:<br>- use appropriate language, symbolic notation and graphic representation to describe the ideas and methods for numerical solving equations;<br>- apply the methods described above in the particular tasks;<br>- describe the concept and define the notions of probability theory;<br>- understand the concepts and apply the methods described above in real situations;<br>- define discrete and continuous random variables and their characteristics;<br>- properly interpret characteristics of random variables on particular examples;<br>- describe examples of important distribution and identify conditions for their use in problem solving;<br>- describe the concept and define the notions of statistics theory;<br>- use a computer and appropriate software as a tool in the statistical data processing;<br>- understand the process of statistical testing and parametric and non-parametric sample testing.</td></tr>
<tr><td>Course content broken down in detail by weekly class schedule (syllabus)</td><td colspan="6">Introduction to the objectives and learning outcomes, curriculum, methods of evaluation and assessment criteria.<br>Errors of approximate values. The types of errors. Sources of errors. (2 + 1)<br>Solving equations approximately. Graphical method. Bisection method. Iteration. Secant method. Tangent method. (4 + 2)<br>Interpolation and approximation. (2 + 1)<br>Numerical integration. Rectangular formula. Trapezium formula. Simpson’s formula. (2 + 1)<br>Numerical solving of differential equations. Euler’s method. Taylor’s method. (2 + 1)<br>Written exam. (0 + 2)<br>Definition and properties of probability. (2 + 1)<br>Conditional probability. Independence of events. (2 + 1)<br>Random variables. Discrete and continuous random variables. Independence of random variables. (2 + 1)</td></tr>
</table>

<table>
<tr><td></td><td colspan="6">Numerical characteristics of random variables. Mathematical expectation. (2 + 1)<br>Dispersion. Mode and median. Moments. The coefficient of skewness and kurtosis. (2 + 1)<br>Some important distributions. Binomial distribution. Poisson distribution. Normal distribution. Uniform distribution. Exponential distributions. (4 + 2)<br>Basics of statistics. Population. Sample. Displaying data. The average value of the sample. Sample variance. Sample mode. Sample median. (2 + 1)<br>Statistical testing. Parametric test. Nonparametric test. $X^2$ test. (2 + 1)<br>Written exam. (0 + 2)</td></tr>
<tr><td>Format of instruction</td><td colspan="3">☐lectures<br>☐seminars and workshops<br>☐exercises<br>☐on linein entirety<br>☐partial e-learning<br>☐field work</td><td colspan="3">☐independent assignments<br>☐multimedia<br>☐laboratory<br>☐work with mentor<br>☐ (other)</td></tr>
<tr><td>Studentresponsibilities</td><td colspan="6">Regular attendance class, take part in discussions and solving problems.</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></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>Independent aasignments</td><td>0.8</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>1.6</td><td>(Other)</td><td></td></tr>
<tr><td>Written exam</td><td>1.6</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">The first method: Engagement during semester 20% (E), written exam 40% (W) and oral exam 40% (O). During the semester, student can do additional task, write a seminar paper and express own knowledge through activities in class. The final score: z = 0.2(E) + 0.4(W) + 0.4(O).<br>The second method: written exam 500% and oral exam 50%; final: z = 0.5(W) + 0.5(O).</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>Availability via other media</td></tr>
<tr><td></td><td colspan="3">1) Bogdanic, N. (1980), Primijenjena matematika, Split: Sveučilište u Splitu</td><td>1</td><td></td></tr>
<tr><td></td><td colspan="3">2) Baranović, N. (2014.) Primijenjena matematika (materijal dostupan na moodlu Filozofskog fakulteta: https://paideia.ffst.hr/learning/login/index.php</td><td></td><td>e-learning</td></tr>
<tr><td>Optional literature (at the time of submission of study programme proposal)</td><td colspan="6">1) Ivanšić, I. (2002). Numerička matematika. Zagreb: Element<br>2) Scitovski, R. (2004). Numerička matematika, Osijek: http://www.mathos.unios.hr/nm/materijali/Num.PDF<br>3) Elezović, N. (2008). Diskretna vjerojatnost. Zagreb: Element<br>4) Elezović, N. (2008). Matematička statistika. Statistički procesi. Zagreb: Element<br>5) Kreyszig, E. (1999). Advanced Engineering Mathematics, New York: J. Wiley & Sons,<br>Inc.,<br>http://faculties.sbu.ac.ir/~sadough/pdf/Advanced%20Engineering%20Mathematics%2010th%20Edition.pdf</td></tr>
<tr><td>Quality assurance methods that</td><td colspan="6">Monitoring of quality and assurance will be performed at three levels:<br>University – Student questionnaire</td></tr>
</table>

| | |
|---|---|
| ensure the acquisition of exit competences | Faculty – Commission for quality control<br>Teacher – Talk with students. |
| Other (as the proposer wishes to add) | |

# Thermodinamics of Real Processes

| **NAME OF THE COURSE** | **Thermodinamics of Real Processes** | | | | | |
|---|---|---|---|---|---|---|
| **Code** | KTB102 | Year of study | 1st | | | |
| Course teacher | PhD, Vanja Martinac, prof. | Credits (ECTS) | 6.5 | | | |
| Associate teachers | PhD, Miroslav Labor, associate prof.<br>PhD, Jelena Jakić, assistant | Type of instruction (number of hours) | P | S | V | T |
| | | | 30 | 15 | 30 | 0 |
| Status of the course | Mandatory | Percentage of application of e-learning | | | | |
| **COURSE DESCRIPTION** | | | | | | |
| Course objectives | The aim of the course is that students acquire knowledge in applying the basic laws of thermodynamics and advanced mathematical methods to solutions of chemical engineering problems. | | | | | |
| 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 are expected to:<br>– evaluate the thermodynamic properties of the pure substances, mixtures and solutions based on the pressure, temperature and composition<br>– select the required literature thermodynamic data and theoretical relationships to describe the dependence of various thermodynamic properties of real gases, mixtures and solutions on pressure and temperature<br>– apply different types of phase diagrams, tables and numerical expressions to display thermodynamic properties of real gases and solutions<br>– calculate the thermodynamic properties of real fluids using the equations of state<br>– calculate the thermodynamic properties of real solutions using a model of the activity coefficient<br>– apply the acquired knowledge of thermodynamic and advanced mathematical methods to solve chemical engineering tasks | | | | | |
| Course content broken down in detail by weekly class schedule (syllabus) | 1st week: General consideration. Thermodynamic probability and Boltzman equation.<br>2nd week: Volumetric properties of real fluids. Equations of state of a real gas and mixture.<br>3rd week: The principle of corresponding states and thermodynamic similarity. Critical compressibility factor. Application to gases and liquids.<br>4th week: Improved principle of corresponding states. Pitzer correlation - acentric factor.<br>5th week: Calculation of the pVT-properties, the comparison equations.<br>6th week: Thermodynamic properties of real fluids - fugacity and fugacity coefficient<br>7th week: Methods of calculating fugacity.<br>8th week: Thermodynamic of real solutions – volume, enthalpy and entropy of mixing, causes of non-ideality of real solutions, regular and athermal solutions. | | | | | |

| | |
|---|---|
| | Exam (I preliminary exam)<br>9th week: Partial molal quantities. Methods of calculation of partial molal quantities in binary mixtures.<br>10th week: Partial fugacity and partial fugacity coefficient<br>11th week: Excess functions. Activity and activity coefficient, standard state for pure gases, liquids and solids and components of gas and liquid mixtures. Activity and activity coefficients from the Gibbs energy.<br>12th week: Activity coefficient models for liquid mixtures.<br>13th week: The third law of thermodynamics and calculation of equilibrium transformation. Heterogeneous reactions-changes in reagents' surface area.<br>14th week: Introduction to thermodynamics of open systems - work, energy and heat, enthalpy, partial molal quantities, heat in open system, relation between entropy and heat, affinity, thermodynamic functions of non-equilibrium states, entropy balance - entropy production and entropy flow in open system, dissipation function, relation between reaction rates and the affinities.<br>15th week: Thermodynamic analysis of elastic deformation of a solid. Equation of state for elastic deforming axis. Caloric properties. Thermodynamic deformation processes. Application of thermodynamic theory to man and society.<br>Exam (II preliminary exam)<br><br>Numeric examples demonstrating the topics covered are analysed during the course and make an integral part with lectures.<br>During exercises, examples from engineering practice are solved using PC and available software.<br><br>Laboratory exercises:<br>1. Thermal storage of solar energy<br>2. Partial molar quantities<br>3. Vapour-liquid equilibrium |
| Format of instruction | **x** lectures<br>☐ seminars and workshops<br>**x** exercises<br>☐ *on line* in entirety<br>☐ partial e-learning<br>☐ field work<br>☐ independent assignments<br>**x** multimedia<br>**x** laboratory<br>☐ work with mentor<br>**x** seminar |
| Student responsibilities | Attendance to lectures and seminars for 80% of the total number of hours. Full attendance to exercises (100% of the total number of hours). |

| 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 | 0.5 | Research | | Practical training | |
| | Experimental work | 1.0 | Report | 0.5 | Solutions of chemical engineering problems | 1.0 |
| | Essay | | Seminar essay | | (Other) | |
| | Tests | 0.5 | Oral exam | 2.0 | (Other) | |
| | Written exam | 1.0 | Project | | (Other) | |

| | |
|---|---|
| Grading and evaluating student work in class and at the final exam | Continuous assessment through partial preliminary exams (twice in a semester) allows for exemption from the written exam. The passing threshold is 60%. Partial preliminary exams are not mandatory. Preliminary exams are not eliminatory. Each passed preliminary exam participates with 18% in the rating. Attendance to |

<table>
<tr><td></td><td colspan="3">lectures and seminars for 80%-100% is 5% of the grade. Activity in lab excercises is 5% of the grade. The oral exam participates with 54 %.<br>A written and an oral exam are held in the examination periods. The oral exam is mandatory for all students, and the written exam is mandatory if a student is not exempt from it. A passed preliminary exam also participates with 10% in the summer examination period. The written exam participates with 36%, and the oral one with 54%. Students who have not passed the written exam through preliminary exams take the full exam (final exam) consisting of the written and the oral exam in regular examination periods. The passing threshold is 60%. The written exam form participates in the rating with 46% and oral one with 54%..<br>Ratings: 60%-70% – satisfactory, 71%-80% – good, 81%-90% – very good, 91%-100% – excellent.</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. Smith, H. C. Van Hess, M. M. Abbott, Introduction to Chemical Engineering Thermodynamics, 7th Ed., McGraw-Hill, New York, 2005.</td><td>1</td><td></td></tr>
<tr><td>S. I. Sandler, Chemical, Biochemical and Engineering Thermodynamics, 4th Ed., Wiley, New York, 2006.</td><td>1</td><td></td></tr>
<tr><td>M. J. Moran, H. N. Shapiro, D. B. Daisie, M. B. Bailey, Fundamentals of Engineering Thermodynamics, 7th Ed., Wiley, New York, 2010.</td><td>1</td><td></td></tr>
<tr><td>P. Ahuja, Chemical Engineering Thermodynamics, PHI Learning, New Delhi, 2009.</td><td>1</td><td></td></tr>
<tr><td>N. Petric, V. Martinac, Chemical Engineering Thermodynamics, Thermodynamics of real processes, (in Croatian), Faculty of Chemistry and Technology, Split, 1998.</td><td>1</td><td></td></tr>
<tr><td>M. Labor, Thermodynamics of real processes, Seminar, ppt prezentation, on line (2014-02-20), (in Croatian), Faculty of Chemistry and Technology, Split, 2014.</td><td></td><td>on line</td></tr>
<tr><td>V. Martinac, J. Jakić, Thermodynamics, laboratory excercises, internal mimeographed notes, (in Croatian), on line (2011-11-15), (in Croatian), Faculty of Chemistry and Technology, 2010.</td><td></td><td>on line</td></tr>
<tr><td colspan="3"></td></tr>
<tr><td colspan="3"></td></tr>
<tr><td>Optional literature (at the time of submission of study programme proposal)</td><td colspan="3">B. E. Poling, J. M. Prausnitz, J. P. O’Connell, The Properties of Gases and Liquids, 5th Ed., McGraw-Hill, New York, 2001.<br>M. Graetzel, P. Infelta, The bases of Chemical Thermodynamics, Vol. 1. & Vol. 2., Universal Publishers, Florida, 2000.</td></tr>
<tr><td>Quality assurance methods that ensure the acquisition of exit competences</td><td colspan="3">Quality assurance will be performed at three levels:<br>(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="3"></td></tr>
</table>

# Instrumental Methods of Analysis

| NAME OF THE COURSE | Instrumental Methods of Analysis | | | | | |
|---|---|---|---|---|---|---|
| Code | KTB103 | Year of study | 1st | | | |
| Course teacher | PhD, Lea Kukoč Modun, assistant prof. | Credits (ECTS) | 6.5 | | | |
| Associate teachers | Maja Biočić, assistant<br>Andrea Anđić, assistant<br>Azra Đulović, assistant | Type of instruction (number of hours) | L | S | E | F |
| | | | 30 | 15 | 30 | |
| Status of the course | Mandatory | Percentage of application of e-learning | 0 % | | | |
| **COURSE DESCRIPTION** | | | | | | |
| Course objectives | The aim of this course is to introduce students to the theoretical principles, practical work and the use of instrumental techniques and procedures relating to the process analysis. The choice of method will depend on the knowledge of the basic principles of individual method or group of methods and the understanding of their advantages and limitations. After completion of a process of learning the learner is able for independent work in instrumental analytical laboratory | | | | | |
| 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. Adopt theoretical knowledge related to methods of instrumental analysis (spectrometry, electroanalytical, thermal methods, instrumental separation methods) and the principles of instruments.<br>2. Correctly interpret the adopted theoretical knowledge relating to methods of analysis instrument and principles of instruments.<br>3. Explain the connection between basic knowledge of analytical chemistry with application in instrument analysis.<br>4. Select analytical technique due to the characteristics of the analyte and the specificity of the sample.<br>5. Integrate acquired knowledge and apply them in problem-solving and decision-making in analytical practice and in process analysis.<br>6. Adopt theoretical knowledge related to methods of instrumental analysis ( spectrometry , electroanalytical , thermal methods , instrumental methods for separation ) and principles of instruments and apply knowledge in the experimental work.<br>7. Select analytical technique due to the characteristics of the analyte and the specificity of the sample.<br>8. Plan and install an experiment using instrumental techniques.<br>9. Apply basic statistical analysis of numerical data and graphed the results.<br>10. Independently take Lab Notes and prepare a report after completion of the analysis. | | | | | |
| Course content broken down in detail by weekly class schedule (syllabus) | 1st week<br>Lectures: Fundamentals of instrumental techniques and their application in continuous and process analysis.<br>Seminars: Introduction, memento. SI system of units. | | | | | |

| | |
|---|---|
| | 2nd week<br>Lectures: Planning and optimizing the experiment. Optimizing analytical control of technology process.<br>Seminars: Kinetic method analysis.<br>3rd week<br>Lectures: Gass chromatography. High performance liquid chromatography. Gass chromatography coloumns and detectors.<br>Seminars: Chromatography (numerical examples).<br>4th week<br>Lectures: Continuous segmentation flow analysis. Flow injection analysis.<br>Seminars: Flow injection analysis, construction of manifold.<br>5th week<br>Lectures: Thermal analysis Termogravimetric methods. Differential thermal analysis.<br>Seminars: Thermal analysis (numerical examples).<br>6th week<br>Lectures: Fundamentals of spectrophotometry. Atomic absorption spectrometry. Flame emission spectrometry. Atomic fluorescence. Atomic emission. Atomic absorption.<br>Seminars: Atomic absorption spectroscopy.<br>7th week<br>Lectures: Ultraviolet / Visible absorption spectrometry.<br>Seminars: Spectrometry (numerical examples).<br>8th week<br>Lectures: Infrared absorption spectrometry. Raman spectrometry.<br>Seminars: Spectrometry (numerical examples).<br>11th week<br>9th week<br>Lectures: Mass spectrometry. Nuclear Magnetic Resonance Spectrometry, Fotoelectron spectrometry. Auger electron spectrometry. Photoelectron spectroscopy. Analysis of surface with electron beams.<br>Seminars: Mass spectrometry, modern ionisation methods.<br>10th week<br>Lectures: Microanalysis with electronic sampling. X-ray diffraction analysis. Scanning electron microskop.<br>Seminars: Potentiometry (numerical examples).<br>11th week<br>Lectures: Electroanalytical methods. Potentiometry. Indicator electrodes. Potentiometric setup.<br>Seminars: Potentiometry (numerical examples).<br>12th week<br>Lectures: Coulometry.<br>Seminars: Electrogravimetry (numerical examples).<br>13th week<br>Lectures: Coulometry<br>Seminars: Coulometry (numerical examples).<br>14th week<br>Lectures: Voltammetry.<br>Seminar: Voltammetry (numerical examples).<br>15th week<br>Lectures: Amperometry. |

<table>
<tr><td></td><td colspan="6">Seminars: Amperometry (numerical examples).<br><br>Experimantal part:<br>1. Kinetic methods of analysis, determoination of tiolic compound using kinetic manifold with spectrophotometric detector.<br>2. Flow injection analysis, determination of ascorbic acid by flow injection analysis and spectrophotometric detector.<br>3. UV/Vis spectrophotometry, spectrophotometric measurement of an equilibrium constant.<br>4. Atomic absorption spectroscopy, determination of metals in real samples.<br>5. Ions selective electrode, potentiometry, measurement of an equilibrium constant.<br>6. Electrogravimetric determination, determination or separation of metals.</td></tr>
<tr><td>Format of instruction</td><td colspan="3">x lectures<br>x seminars and workshops<br>x exercises<br>□on linein entirety<br>□partial e-learning<br>□field work</td><td colspan="3">x independent assignments<br>x multimedia<br>x laboratory<br>□work with mentor<br>x team based learning</td></tr>
<tr><td>Studentresponsibilities</td><td colspan="6">The 70% presence at lectures and seminars. Students must do all laboratory exercises in planned program.</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></td><td>Research</td><td></td><td>Practical training</td><td></td></tr>
<tr><td>Experimental work</td><td>5% (0,33 ECTS)</td><td>Report</td><td></td><td>Test of numerical examples</td><td>30 % (1,95 ECTS)</td></tr>
<tr><td>Essay</td><td></td><td>Seminar essay</td><td></td><td>Test of teoretical part</td><td>50 % (3,25 ECTS)</td></tr>
<tr><td>Tests</td><td></td><td>Oral exam</td><td>15 % (0,97 ECTS)</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>Grading and evaluating student work in class and at the final exam</td><td colspan="6">Scoring at the exam consists of three basic parts: scoring the experimental part (minimum score 2 , maximum score 4), test of numerical example (minimum score: 18; maximum score: 30) and test of theoretical part (minimum score: 39; maximum score: 65).<br>Students who had attended lectures and seminar in 70 % can take the exam through partial tests: 2 tests of numerical examples (minimum score: 9; maximum score: 15) and 2 tests of theoretical part (minimum score: 19,5; maximum score: 32,5).<br>The rating is formed in accordance with the score ranges: sufficient ( 60 - 70 points) , good ( 71-80 points) , very good ( 81-90 points) , excellent ( ≥91points ).</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 colspan="2">Availability via other media</td></tr>
<tr><td colspan="3">D.A. Skoog, D.M. West, F.J. Holler, Osnove analitičke kemije, šesto izdanje (englesko), prvo izdanje (hrvatsko), Školska knjiga, Zagreb, 1999.</td><td>18</td><td colspan="2"></td></tr>
<tr><td colspan="3">Nj. Radić i L. Kukoč Modun, Uvod u analitičku kemiju I. dio, Redak, Split, 2013.</td><td>32</td><td colspan="2"></td></tr>
<tr><td colspan="3">M. Kaštelan-Macan, Kemijska analiza u sustavu kvalitete, Školska knjiga, Zagreb 2003.</td><td>3</td><td colspan="2"></td></tr>
<tr><td colspan="3">I. Piljac, Elektroanalitičke metode, RMC, 1995.</td><td>3</td><td colspan="2"></td></tr>
</table>

| | | | |
|---|---|---|---|
| | I. Piljac, Senzori fizikalnih veličina i analitičke metode, Zagreb, 2010. | 3 | |
| | Analitika okoliša (ur. M. Kaštelan Macan, M. Petrović), HINUS i FKIT, Zagreb 2013. | 3 | |
| | I. S. Krull, Analytical Chemistry, Intech, Rijeka, 2012. | | available on web: DOI: 10.5772/3086 |
| | L. Kukoč, Molekulska spektroskopija, Interna recenirana skripta, 2003. | 30 (u ZAK) | available in digital form |
| | L. Kukoč, Spektrometrijske metode elementne analize, Interna recenirana skripta, 2005. | 30 (u ZAK) | available in digital form |
| | Josipa Komljenović, Ion selektivna sulfidna elektroda, Interna recenzirana skripta | 30 (u ZAK) | available in digital form |
| | | | |
| Optional literature (at the time of submission of study programme proposal) | 1. R. Kellner, J. M. Mermet, M. Otto, M. Valcarcel and H. M. Widmer (Urednici), Analytical Chemistry (A Modern Approach to Analytical Science, Second Edition) Wiley-VCHVerlag Gmbh & Co. KGaA, Weinheim, 2004.<br>2. D. A. Skoog, D. M. West, F. J. Holler and S. R. Crouch, Fundamentals of Analytical Chemistry, Eighth Edition, Thompson Brooks/Cole, Belmont, USA, 2004.<br>3. G. D.Christian, Analytical Chemistry, Sixth Edition, John Willey & Sons, INC, 2004.<br>4. D. Harvey, Modern Analytical Chemistry, McGraw-Hill Higher Education, New York, London, 2000.<br>5. F. W. Fifield & D. Kealey, Principles and Practice of Analytical Chemistry, Blackwell Science Ltd, Malden MA, London, 2000.<br>6. M. Kaštelan-Macan, Enciklopedijski rječnik analitičkog nazivlja, FKIT, Mentor, Zagreb 2014. | | |
| Quality assurance methods that ensure the acquisition of exit competences | Quality assurance will be performed at three levels:<br>(1) University Level; (2) Faculty Level by Quality Control Committee; (3) Lecturer's Level. | | |
| Other (as the proposer wishes to add) | | | |

# Process Automatic Control

| **NAME OF THE COURSE** | **Process Automatic Control** | | | | | |
|---|---|---|---|---|---|---|
| Code | KTB104 | Year of study | 1st year of graduate study | | | |
| Course teacher | PhD, Jadranka Marasović, prof. | Credits (ECTS) | 6.5 | | | |
| Associate teachers | PhD, Sandra Svilović, associate prof. | Type of instruction (number of hours) | L | S | E | F |
| | | | 2 | 1 | 2 | 0 |
| Status of the course | Mandatory | Percentage of application of e-learning | | | | |

<table>
<tr><th colspan="7">COURSE DESCRIPTION</th></tr>
<tr><td>Course objectives</td><td colspan="6">Enable students to understand the importance of automated systems, to comprehend how danger can be potentially poorly designed control systems. Enable students to understand that the process automatic control is very difficult task and for its realization it is necessary to connect numerous different subsystems and the resulting creation is very complex system. But, for its proper work it was necessary to harmonize different subsystems characteristics introducing many compromises while trying to connect all of them.</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 completing this course, students will be able to describe different automatic and controlled processes realizations. Students will be able to describe the problems of implementation such different realizations in real life situations. They will be able to explain with arguments why some ides of control theory can be or cannot be implemented different real life tasks.</td></tr>
<tr><td>Course content broken down in detail by weekly class schedule (syllabus)</td><td colspan="6">System theory and control theory. Mathematical modeling. Examples of mathematical models of physical systems. Laplace transformation, transfer function, transient part of time domain analysis, frequency domain analysis. Analysis of first and second order processes. Digital computer as process controller. Behavior of feedback loop controlled systems. First and second order processes in control loop. Control loop objectives. Stability analysis. Routh criterion. Nyquist criterion. Control loop synthesis. Nonlinear systems and nonlinear control loop analysis. Design and characteristics of controllers. Regulation valve. Self-regulating control loop systems. Examples of modern control theory: expert systems, neural networks, fuzzy logic. Examples of process control ( thermal systems, chemical reactor systems, drying systems, distillation).</td></tr>
<tr><td>Format of instruction</td><td colspan="3">☐lectures<br>☐seminars and workshops<br>☐exercises<br>☐on line in entirety<br>☐partial e-learning<br>☐field work</td><td colspan="3">☐independent assignments<br>☐multimedia<br>☐laboratory<br>☐work with mentor<br>☐ (other)</td></tr>
<tr><td>Students reponsibilities</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>1.5 ECTS</td><td>Research</td><td></td><td>Practical training</td><td>1.5 ECTS</td></tr>
<tr><td>Experimental work</td><td></td><td>Report</td><td></td><td>Independent learning (Other)</td><td>2 ECTS</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 ECTS</td><td>Oral exam</td><td></td><td>(Other)</td><td></td></tr>
<tr><td>Written exam</td><td>0.5 ECTS</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, there will be two mid-term exams. At the end of the semester, students will take a written exam. In order to get a positive grade from this course, students need to acquire minimum 50% of the total score on each of the mid-term exams or at the final exam.<br>The final grade is determined as follows:</td></tr>
</table>

| | | | |
|---|---|---|---|
| | Percentage Grade<br>50% to 61% sufficient (2)<br>62% to 74% good (3)<br>75% to 87% very good (4)<br>88% to 100% excellent (5) | | |
| Required literature (available in the library and via other media) | **Title** | **Number of copies in the library** | **Availability via other media** |
| | 1. J. Božičević, Basics of Automatic Control 1 (in Croatian: Temelji automatike 1, Školska knjiga, Zagreb, 1992; | | |
| | 2. J. Božičević, Process Automatic Control (in Croatian: Automatsko vođenje procesa, Tehnička knjiga, Zagreb, 1971. | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| Optional literature (at the time of submission of study programme proposal) | 1. D.E. Seborg, T.F. Edgar, D.A. Mellichamp, Process Dynamics and Control, J. Wiley, New York, 1989;<br>2. W.J Palm, Control System Engineering, J. Wiley, New York, 1994. | | |
| Quality assurance methods that ensure the acquisition of exit competences | During the semester, there will be two mid-term exams. At the end of the semester, students will take a written exam. Each mid-term exam and the final exam will consist of several short questions intended to evaluate the students' understanding of the theory and their ability to describe the fundamental concepts, as well as to test students' ability to apply the theory onto simple, practical examples.<br>Quality and accomplishment assurance will be performed at three separate levels: (1) University level, (2) Faculty level, by the Teaching Quality Control Committee, (3) Professor's Level. | | |
| Other (as the proposer wishes to add) | | | |

# Mechanical and Thermal Operations

| **NAME OF THE COURSE** | **Mechanical and Thermal Operations** | | | | | |
|---|---|---|---|---|---|---|
| Code | KTB105 | Year of study | 1st | | | |
| Course teacher | PhD, Marija Ćosić, assistant prof. | Credits (ECTS) | 6.5 | | | |
| Associate teachers | PhD, Nenad Kuzmanić, prof.<br>Antonija Kaćunić, assistant | 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 | To acquaint the students with mechanisms which follow performance of individual mechanical and thermal operation and with the state of product during transformation of material systems. Enables the students to apply general procedure to design equipment and to choose optimal process conditions taking into account energy costs and product quality. | | |
| 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 the student is expected to know:<br>- explain fundamental principles of mechanical and of thermal operations,<br>- recognize the major resistance during the performance of individual operation and explain how to improve operation performance,<br>- the functional dependence of the characteristics of a given system using equations for process dimensioning,<br>- suggest the most common used equipments for particular operation and explain their working principle,<br>- bring up some of the most common operating problems encountered in the mechanical and heat transfer operations. | | |
| Course content broken down in detail by weekly class schedule (syllabus) | 1st week: Mechanical and thermal operations in the process engineering. . Elementary principles of mechanical operations. Separation operations which include mass and heat transfer.<br>2nd week: Introduction to particle size characterization. The characterization of dispersion systems. Representing of the extent of mixing and the state of dispersivity.<br>3th week: Gravity sedimentation process, gravity classifiers and thickeners and their design.<br>4th week: Centrifugal sedimentation process. Equipment for centrifugal sedimentation.<br>5th week: Centrifugal filters. Hydrocyclone geometries and operational conditions.<br>6th week: Size reduction operation; crushing and milling operations. Equipment for size reduction.<br>7th week: Solid-gas filtration and types of filters. Electrostatic precipitation. Mechanism of an electrostatic precipitator. Mechanisms of scrubbing and types of scrubbers<br>8th week: Basic concepts of adsorption. Adsorber design.<br>9th week. Theory of crystallization.<br>10th week: Industrial crystallization equipment.<br>11th week: Leaching. Leaching equipment.<br>12th week: Extraction. Extraction equipment.<br>13th week: Membrane separation processes. Membrane structure. Elementary principles of ultrafiltration, electrodialysis and reverse osmosis.<br>14th week: Mixing in heterogeneous system. Solid-liquid mixing; suspension of floating and settling solids.<br>15th week: Mixing in heterogeneous system. Gas-liquid dispersion.<br><br>Laboratory exercise:<br>Granulometric characterization of dispersed systems by analytical functions. Gravity | | |

<table>
<tr><td></td><td colspan="6">settling processes - determination of sedimentation rate of suspension.<br>Milling- determination of reduction degree<br>Crystallization: determination of kinetics of nucleation and crystal growth,<br>Mixing – determination of influence of operating conditions on homogenization time and complete suspension state.<br>Adsorption – Influence of temperature and adsorbent surface area on adsorption rate<br>Extraction – determination of the numbers of extraction stages<br><br>Field work:<br>Gravity sedimentation - Optimization of operating conditions of the circular gravity thickener (wastewater treatment plant, Trilj)<br>Gravity sedimentation - Optimization of operating conditions of the horizontal gravity thickener (wastewater treatment plant, Sinj)<br>Determination of suspension flow in the disc type centrifuge (treatment plant oily water Cian - Solin).<br>Determination of the optimal working conditions of the centrifuge with a helical-conveyor (treatment plant oily water Cian - Solin).<br>Milling: process control of in industrial ball mill (Cemex, Kaštel Sućurac).<br>Solid-gas filtration: process parameters control of the bag filters and electrofilters (CEMEX - Kastel Sućurac)</td></tr>
<tr><td>Format of instruction</td><td colspan="3">x lectures<br>x seminars<br>x exercises<br>□on linein entirety<br>□partial e-learning<br>x field work</td><td colspan="3">□independent assignments<br>x multimedia<br>x laboratory<br>□work with mentor<br>□ (other)</td></tr>
<tr><td>Student responsibilities</td><td colspan="6">Lecture attendance: 80 %. Laboratory exercises and field work 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>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>Laboratory exercises (Other)</td><td>1.25</td></tr>
<tr><td>Essay</td><td></td><td>Seminar essay</td><td></td><td>Field work(Other)</td><td>1.25</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></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 student may take the exam by two oral tests. Tests are consisting of questions from lectures and seminars. Test passing score is 55%. After passing both tests the grade of theoretical part is determined by the following criteria: 55%-66% - satisfactory, 67%-78% - good, 79%-89% - very good, 90%-100% - excellent.<br>The final grade is calculated form the grade of oral test and grades from laboratory exercises and field work. Theoretical part constitutes 67% of grade while grade of laboratory exercises and filed work together made 33 % of final grade. Students who do not pass the partial exams have to take an oral exam in the regular examination periods. Final grade is determined by previously notated criteria.</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">W. L. McCabe, J. C. Smith, P. Harriott, Unit</td><td>2</td><td></td></tr>
</table>

| | | | |
|---|---|---|---|
| | Operations of Chemical Engineering, 7th ed., McGraw-Hill, New York, 2004. | | |
| | C. J. Geankoplis, Transport Prosesses and Separation Process Principles (Includes Unit Operations), 4th ed., Pearson Eucation, Inc.,New Jersey, 2007. | 1 | |
| | Hraste, Mehaničko procesno inženjerstvo, 2. izdanje, HINUS, Zagreb, 2003. | 5 | |
| | V. Koharić: Mehaničke operacije, FSB, Zagreb, 1996. | 3 | |
| | J. Welty, J. W. Wicks, R. E. Wilson, G. L. Rorrer, Fundamentals of Momentum, Heat and Mass Transfer, 5th ed., J. Wiley & Sons Inc., New York, 2007. | 2 | |
| Optional literature (at the time of submission of study programme proposal) | E. Beer., Priručnik za dimenzioniranje uređaja kemijske industrije, HDKI/Kemija u industriji, Zagreb, 1980.<br>R.H. Perry, D.W. Green, J.O. Maloney, Perry's Chemical Engineer's Handbook, 7th ed., McGraw-Hill, New York, 2007.<br>E. L. Paul, V. A. Atiemo-Obeng, S. Kresta, Handbook of Industrial Mixing, John Wiley and Sons, Inc., New Jersey, 2004.<br>J. W. Mullin, Crystallization, 4th ed, Butterworth-Heinemann, Oxford, 2001. | | |
| Quality assurance methods that ensure the acquisition of exit competences | - monitoring of students suggestions and reactions during semester<br>- students evaluation organized by University | | |
| Other (as the proposer wishes to add) | | | |

# Chemical Reactors

| **NAME OF THE COURSE** | **CHEMICAL REACTORS** | | | | | |
|---|---|---|---|---|---|---|
| Code | KTB 106 | Year of study | 1st | | | |
| Course teacher | Sandra Svilović | Credits (ECTS) | 5.0 | | | |
| Associate teachers | | Type of instruction (number of hours) | L | S | E | F |
| | | | 30 | 15 | 15 | 0 |
| Status of the course | Mandatory | Percentage of application of e-learning | | | | |
| **COURSE DESCRIPTION** | | | | | | |
| Course objectives | Students will be acquainted with the knowledge in the field of chemical reaction engineering especially different types of chemical reactors. | | | | | |
| Course enrolment requirements and entry competences required for the course | | | | | | |
| Learning outcomes | After completing the course, the student will be able to: | | | | | |

<table>
<tr><td>expected at the level of the course (4 to 10 learning outcomes)</td><td colspan="6">- describe the steps in heterogeneous reactions<br>- describe various types of bioreactors<br>- discuss how one goes form a region mass transfer limitation to reaction limitation<br>- describe various types of multiphase reactors and their application<br>- determine the reaction order and specific reaction rate from experimental data obtained from reactors using linear and nonlinear regression.<br>- compare kinetic models and to choose the best fit model for kinetic experiment data</td></tr>
<tr><td>Course content broken down in detail by weekly class schedule (syllabus)</td><td colspan="6">1st week: Introduction, reactor as a processing unit in a technological process. Living example problems<br>2nd week: Heterogeneous chemical reactions. Determination of rate-controlling step. Kinetics of heterogeneous (gas -liquid) reactions. Examples on seminars<br>3rd week: Kinetics of heterogeneous catalytic reaction. Experimental catalytic reactors. Examples on seminars<br>4th week: Biological reaction fundamentals.<br>5th week: Biocatalysts. Bioreactors for microbial cell culture.<br>6th and 7th week: Bioreactors for plant and animal cell and tissue culture. Enzyme bioreactors.<br>8th and 9th week: Adiabatic operation of a batch reactor. Examples on seminars. Partial knowledge test<br>10th week: Continuous stirred tank reactor in series; CTRS in parallel. Mixing in CST and batch reactors. Heat transport in CST and batch reactors. Examples on seminars. Sterilization.<br>11th week: Combinations of CSTRs and PFRs in series. Examples on seminars..<br>12th week: Tubular reactors- 1D and 2D models for homogenous reactions. Material balances. Model for axial dispersion, model for laminar flow<br>13th week: Tubular reactors- 1D and 2D models for heterogeneous reactions.<br>14th week: Multiphase reactors<br>15th week: Microreactors. Reactors evaluation and ratings<br>Partial knowledge test<br><br>Exercises: Kinetics of homogenous reaction. Kinetics of heterogeneous reactions: influence of agitation speed on rate-controlling step, influence of particle size on rate-controlling step. Determination of the reaction order and specific reaction rate from experimental data obtained from batch reactor using linear and nonlinear regression (Mathcad).</td></tr>
<tr><td>Format of instruction</td><td colspan="3">x lectures<br>□ seminars and workshops<br>x exercises<br>□on linein entirety<br>□partial e-learning<br>□field work</td><td colspan="3">x independent assignments<br>x multimedia<br>x laboratory<br>□work with mentor<br>x seminars</td></tr>
<tr><td>Student responsibilities</td><td colspan="6">Regular attendance and active participation at lectures, seminars and exercises.</td></tr>
<tr><td rowspan="4">Screening student work(name the proportion of ECTS credits for each activity so that the total number of ECTS credits is</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>1.0</td><td>Report</td><td>0.5</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>0.5</td><td>(Other)</td><td></td></tr>
</table>

| | | | | | | |
|---|---|---|---|---|---|---|
| *equal to the ECTS value of the course)* | Written exam | 1.0 | Project | | (Other) | |
| 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.<br>Scoring: <55% insufficient;55-66% sufficient (2); 67-79% good (3); 80-92% very good (4); 93-100% excellent (5) | | | | | |

| | **Title** | **Number of copies in the library** | **Availability via other media** |
|---|---|---|---|
| Required literature (available in the library and via other media) | Z. Gomzi, Kemijski reaktori, HINUS, Zagreb, 1998. | 10 | |
| | S. G. Fogler, Elements of, Chemical Reaction Analysis and Design, Prentice-Hall, Englewood, N.J.,2006 | 1 | |
| 2. | V. Marić, B. Šantek. Biokemijsko inženjerstvo, Zagreb, 2009 | 1 | |
| Optional literature (at the time of submission of study programme proposal) | S. Zrnčević, Kataliza i katalizatori, HINUS, Zagreb, 2005. | | |
| Quality assurance methods that ensure the acquisition of exit competences | Quality of the teaching and learning, monitored at the level of the<br>(1) teachers, accepting suggestions of students and colleagues, and<br>(2) faculty, conducting surveys of students on teaching quality. | | |
| Other (as the proposer wishes to add) | | | |

# Electrochemical Engineering

| **NAME OF THE COURSE** | **Electrochemical Engineering** | | | | | |
|---|---|---|---|---|---|---|
| Code | KTB107 | Year of study | 1st | | | |
| Course teacher | PhD, Maja Kliškić, prof. | Credits (ECTS) | 6.5 | | | |
| Associate teachers | | Type of instruction (number of hours) | L | S | E | F |
| | | | 30 | 30 | 30 | |
| Status of the course | Mandatory | Percentage of application of e-learning | - | | | |
| **COURSE DESCRIPTION** | | | | | | |
| Course objectives | Student will be able to use the aspects of electrochemical engineering on electrochemical processes. Also, he will be introduced to fundamental principles for optimisation electrochemical processes. | | | | | |
| Course enrolment requirements and entry competences required for the course | | | | | | |
| Learning outcomes expected at the | By the end of this course, students will be able to: | | | | | |

<table>
<tr><td>level of the course (4 to 10 learning outcomes)</td><td colspan="6">- define the components in the electrochemical reactor, and describe the operation in the same<br>- define which materials are used for manufacturing electrochemical reactors and their components<br>- evaluate the balance of power, materials and energy in the electrochemical reactor<br>- differentiate primary and secondary current distribution and potential<br>- define the basic types of electrochemical reactors<br>- ascertain and select the ways of connecting the electrodes and the reactor in practice</td></tr>
<tr><td>Course content broken down in detail by weekly class schedule (syllabus)</td><td colspan="6">1st week: Introduction. Technology of electrochemical processes. Constituent parts and operation in Electrochemical reactor.<br>2nd week: Velocity of electrochemical reactions and material balance.<br>3rd week: Minimum voltage for electrolysis. Balance on electrode. Required working potential.<br>4th week: Individual reactions in electrochemical reactors. Efficiency and energy balance.<br>5th week: Transport phenomena in electrochemical systems – complex systems.<br>6th week: Current and potential distributions on working electrode.<br>7th week: Electrochemical reactor with parallel plane electrodes. Annular geometry electrochemical reactor.<br>8th week: First test<br>9th: Electrochemical reactor with vibrating and rotating electrode. Electrochemical reactor with free convection.<br>10th week: Electrochemical reactor with bubbling gas mixture.<br>11th week: Electrochemical reactor with porous electrode. Electrochemical reactor with movement particles electrode.<br>12th week: Description and qualification of electrochemical reactor.<br>13th week: Demand in construction of electrochemical reactor. Type of materials for construction of electrochemical reactor.<br>14th week: Corrosion systems.<br>15th week: Second test<br>Exercises:<br>Distribution of potential in electrolysis, Natural convection, Forced convection, Electrocatalysis, Electrochemical studies on a rotating disc electrode, Electrochemical tests in a flow reactor.</td></tr>
<tr><td>Format of instruction</td><td colspan="3">xlectures<br>xseminars and workshops<br>xexercises<br>□on linein entirety<br>□partial e-learning<br>□field work</td><td colspan="3">□independent assignments<br>□multimedia<br>□laboratory<br>□work with mentor<br>□ (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>2</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></td><td>(Other)</td><td></td></tr>
<tr><td>Tests</td><td>3.5</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>
</table>

| | | | |
|---|---|---|---|
| Grading and evaluating student work in class and at the final exam | The complete exam can be passed through two tests during semester. The passing score is 60 % and the fraction of each test is 40%. In the final grade laboratory exercises has fraction of 20%. In the exam period the student has to attend to oral exam (passing score is 60%). Grades: successful (60% – 69%), good (70% – 79%), very good (80% – 89%), excellent (90% – 100%). | | |
| Required literature (available in the library and via other media) | **Title** | **Number of copies in the library** | **Availability via other media** |
| | K. Scott, Electrochemical Reaction Engineering, Academic Press, London, 1991. | 1 | |
| | F. Goodridge, K. Scott, Electrochemical Process Engineering, Plenum Publishing Corporation, New York, 1995. | 1 | |
| | S.Zečević, S. Gojković, B. Nikolić, Elektrohemijsko inženjerstvo, Tehnološko-metalurški fakultet, Beograd, 2001. | 1 | |
| | F. Lapicque, A. Strock, A. A. Wragg, Electrochemical Engineering and Energy, Plenum Publishing Corporation, New York, 1990. | 1 | |
| | | | |
| | | | |
| | | | |
| | | | |
| Optional literature (at the time of submission of study programme proposal) | S.Zečević, S. Gojković, Elektrohemijsko inženjerstvo-zbirka zadataka, Tehnološko-metalurški fakultet, Beograd, 2001. | | |
| Quality assurance methods that ensure the acquisition of exit competences | - Tracking suggestions and reactions of participants during the semester<br>- Student survey | | |
| Other (as the proposer wishes to add) | | | |

# Inorganic Processes in Heterogeneous Systems

| **NAME OF THE COURSE** | **Inorganic Processes in Heterogeneous Systems** | | | | | |
|---|---|---|---|---|---|---|
| Code | KTB108 | Year of study | 1 | | | |
| Course teacher | PhD, Jelica Zelić, prof. | Credits (ECTS) | 8.0 | | | |
| Associate teachers | PhD, Mario N. Mužek, assistant | Type of instruction (number of hours) | L | S | E | F |
| | | | 45 | 15 | 30 | 15 |
| Status of the course | Mandatory | Percentage of application of e-learning | | | | |
| **COURSE DESCRIPTION** | | | | | | |
| Course objectives | Qualifying students to adopt and apply the knowledge of the fundamental principles of chemical processes of creating and obtaining technically important materials that occur at elevated and high temperatures and about processes that enable the use of these and similar materials, with special emphasis on techno-economic and | | | | | |

| | |
|---|---|
| | environmental aspects. |
| 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 the student will be able to:<br>1. Apply basic principles of chemical processes that are carried out at elevated and high temperatures in heterogeneous systems.<br>2. Categorize the processes of thermal decomposition.<br>3. Assess the conditions for the formation and dissociation of metal oxides.<br>4. Explain the process of sintering and mechanisms of reactions in the solid state.<br>5. Interpret phase diagrams for systems important in the production of Portland cement and in the synthesis of pure ingredients of cement clinker.<br>6. Illustrate ways of applying the basic theory of the reduction of metals in the blast furnace processes, and of the metallothermic reduction of metal oxides in the ferroalloys production.<br>7. Use the basic theory of oxidation and the metals oxidizing refining processes in the production of steel and other metals.<br>8. Explain the basic theory of the production of metals by electrolysis of molten salts, and of the production of technical glass from silicate melts.<br>9. Explain the kinetics and mechanisms of the Portland cement hydration and propose the cement hydration processes for the permanent disposal of hazardous substances and industrial waste in order to support sustainable development and environmental protection.<br>10. Choosing the correct engineering approach to solving similar problems on the basis of the knowledge acquired. |
| Course content broken down in detail by weekly class schedule (syllabus) | 1st week: Introduction. General principles and rules in the implementation of chemical processes. Thermal decomposition processes (dehydration and dehydroxylation, and thermal dissociation). Dehydration of gypsum. Dehydration and dehydroxylation of clay.<br>2nd week: Thermal dissociation of the metal oxides, hydroxides and sulfates. Affinity of metals for oxygen and dissociation pressures of oxides. Model, mechanism and conditions of the carbonate dissociation.<br>Seminar: The thermal dissociation of limestone and the production of lime. Problem solving.<br>3rd week: Processes of technical silicates formation. Sintering processes and reactions in the solid state. The mechanism of the reaction. The driving force of the process. The mechanism of mass transfer. Chemical and physical changes during sintering.<br>Seminar: The phase diagrams. Gibbs phase rule. The ternary system $CaO$-$SiO_2$-$Al_2O_3$ with the areas (zones) of the occurrence of certain technical silicates. Problem solving.<br>4th week: Portland (silicate) cement. Production of Portland Cement. Basic minerals of clinker. Cement modules. Classification of Portland cement according to European norm, EN 197-1.<br>Seminar: The technological scheme of the Portland cement production. Calculation of the mixture for the Portland clinker production. Problem solving.<br>5th week: Technical silicates obtained by sintering in the silica-alumina system. Classic ceramic materials. Pottery supplies, tile, porcelain. Refractory materials.<br>Seminar: The $SiO_2$-$Al_2O_3$ phase diagram. Diagram stability of $SiO_2$. Refractory materials based on the $MgO$-$SiO_2$ system. Forsterite, periclase.<br>6th week: Processes of silicate and aluminate formation in melts. Examples: water glass, aluminous cement. The written knowledge tests (I Colloquium).<br>7th week: Silicate melts. Glass. Definition. The role of major ions in the glass. Devitrification. Crystallization. Technical glass. Chemical composition, classification, properties and practical application. Physico-chemical and mechanical properties of |

| | |
|---|---|
| | glass.<br>8th week: Technological processes and methods for making technical glass. Raw materials. Melting and transformation of raw materials into glass. The $Na_2O$-$SiO_2$ system. Shaping and processing of glass. Cooling and surface treatment of glass.<br>Seminar: The technological scheme of technical glass production. Calculation of the mixture for the production of colorless and colored (green) glass. Problem solving.<br>9th week: Manufacture of carbon materials, graphite, carbides. The reduction of metallic oxides with carbon and carbon monoxide. The blast furnace process. Oxidizing refining processes of the metals in the melts. Mettalothermic reduction and electrothermic reduction of metallic oxides in the production of ferroalloys.<br>Seminar: Examples of the MeO reduction and of oxidizing refining processes in industrial practice. The reduction of iron oxides and production of iron in the blast furnace. Steel. Ferroalloys.<br>10th week: Electrolysis in the melts. Electrolysis of alumina for the production of aluminum. Current density. Anode effect. The technological scheme of the aluminium production. Problem solving. The written knowledge tests (II Colloquium).<br>11th week: Inorganic processes in heterogeneous systems at low temperatures. Hydration processes of products of the thermal decomposition (gypsum plaster and lime). Hydration and hardening of gypsum plaster and lime. The factors affecting the reactivity of lime.<br>Seminar: The production of lime and gypsum. Plants, basic operations and devices. Furnaces.<br>12th week: Inorganic processes in heterogeneous systems at low temperatures. The processes of hydration, setting and hardening of the silicate cement (Portland cement). The mechanism and kinetics of hydration. Hydration products in the cement-water system.<br>Seminar: Application of thermal methods (DTA-TG/DTG) in the chemistry of cement. Kinetics and mechanisms of the Portland cement hydration. Problem solving.<br>13th week: Development of microstructure and corrosion stability of cement composite binder. Factors affecting the strength of concrete. Hydration and hardening of the aluminate cement.<br>Seminar: Practical examples. Influence of pozzolanic additions to the strength and durability of cement composites.<br>14th week: Additives for cement and concrete. Plasticizers and superplasticizers. Air-entraining agents. Supplementary cementing materials. Concrete. Composite materials.<br>15th week: The role of cement hydration processes in the permanent disposal of hazardous substances and industrial waste. Sustainable development. Environmental protection. The written knowledge tests (III Colloquium).<br>SEMINARS:<br>During the semester is processed numerical tasks (practice examples) to calculate the process parameters with the flow diagrams presentation of selected technological processes (physical and chemical base processes, equipment and environmental impact), which together with lectures seems a whole.<br><br>EXERCISES:<br>1. Determination of reactivity of lime depending on the production conditions.<br>2. Determination of particle size and particle size distribution by the Andreasen pipette.<br>3. Determination of physico-chemical properties of silicate cement (density, specific surface area, normal consistency, setting time, heat of hydration).<br>4 Determination of the cation exchange capacity of clays by the ammonium acetate method, and identification of the clay minerals.<br>5. Determination of chemical resistance of the $Na_2O$-$CaO$-$SiO_2$ glass.<br>6. Field work - visit technological facilities for the production of concrete, gypsum, lime, Portland cement and glass. |

<table>
<tr><td>Format of instruction</td><td colspan="3">x lectures<br>x seminars and workshops<br>x exercises<br>☐on linein entirety<br>☐partial e-learning<br>x field work</td><td colspan="3">x independent assignments<br>x multimedia<br>x laboratory<br>☐work with mentor<br>☐(other)</td></tr>
<tr><td>Student responsibilities</td><td colspan="6">Implementation and analysis of selected processes according to preset conditions. Each student is required to do the entire exercises planned program and field work (100%). On completion of all exercises the final written exam is obligated.</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>3.0</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>0,5</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>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>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 three (3) partial tests during the semester. Test passing score is 60%. Students who do not pass the partial exams have to take an exam in the regular examination periods. The exam consists of theoretical (oral) and written part. Exam passing score is 60%.<br>Grades depending on the test score: 60% - 70% - satisfactory, 71% -81% - good, 82% -92% very good, and 93% 100% - excellent.</td></tr>
<tr><td rowspan="6">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">J. Zelić, Practicum in the processes of inorganic industry/Praktikum iz procesa anorganske industrije, (in Croatian), Faculty of Chemistry and Technology in Split, Split, 2013 (reviewed and edited teaching materials),<br>http:// www.ktf-split.hr/bib/nm/Procesi _anorganske_ industrije.pdf</td><td>1</td><td>www.ktf-split.hr</td></tr>
<tr><td colspan="3">Z. Osmanović, J. Zelić, Portland Cement Production/Proizvodnja Portland-cementa, Manualia Universitatis Studiorum Tuzlaensis, University of Tuzla, Tuzla, BiH, 2010., ISBN 978-9958-897-04-7.<br>http://www.knjiga.ba/proizvodnja_portlandj_cementa -k7412.html</td><td>5</td><td>www.knjiga.ba</td></tr>
<tr><td colspan="3">J. Zelić, Z. Osmanović, Strength and Durability of Cement Composites/ Čvrstoća i trajnost cementnih kompozita, (in Croatian), Manualia Universitatis Studiorum Spalatensis, University of Split, Split, 2014, ISBN 978-953-7803-01-8.</td><td>1</td><td>www.ktf-split.hr</td></tr>
<tr><td colspan="3">R. Krstulović, Technological Processes in Inorganic Industry/Tehnološki procesi anorganske industrije, (in Croatian), Manualia Universitatis Studiorum Spalatensis, University of Split, Split, 1986</td><td>5</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">1. R. M. German, Sintering Theory and Practice, Wiley & Sons, Inc., New York, 1996, ISBN 978-0-471-05786-4.<br>2. M. Tecilazić-Stevanović, Osnovi tehnologije keramike, Univerzitet u Beogradu, Tehnološko-metalurški fakultet, Beograd, 1990., YU ISBN 86-7401-065-2.</td></tr>
<tr><td>Quality assurance</td><td colspan="6">Quality of the teaching and learning monitored at the level of the</td></tr>
</table>

| | |
|---|---|
| methods that ensure the acquisition of exit competences | (1) teachers, accepting suggestions of students and colleagues, and<br>(2) Faculty, conducting surveys of students on teaching quality. |
| Other (as the proposer wishes to add) | |

# Polymerization Processes

| **NAME OF THE COURSE** | **Polymerization Processes** | | | | | |
|---|---|---|---|---|---|---|
| Code | KTB109 | Year of study | 1. | | | |
| Course teacher | PhD, Matko Erceg, associate prof. | Credits (ECTS) | 8.0 | | | |
| Associate teachers | | Type of instruction (number of hours) | L | S | E | F |
| | | | 45 | 15 | 45 | |
| Status of the course | Mandatory | Percentage of application of e-learning | | | | |
| **COURSE DESCRIPTION** | | | | | | |
| Course objectives | - introduction to mechanisms and kinetics of polymerization reactions (step-growth and chain polymerization) and their technological implementation<br>- training for work in a manufacturing plant and / or laboratory<br>- understanding the importance of polymers in modern society | | | | | |
| 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 passing the exam, the student is expected to be able to:<br>- distinguish basic types of polymers<br>- enumerate the raw material for the production of polymers<br>- differentiate the basic polymerization reaction<br>- explain the parameters for the polymerization process<br>- explain that širokoprimjenjivi polymers are obtained which polymerisation reactions<br>- implement selected polymerization reaction in laboratory equipment<br>- conclude on the importance of polymers in modern society<br>- use the acquired knowledge in engineering practice | | | | | |
| Course content broken down in detail by weekly class schedule (syllabus) | 1st week: Introduction. World production of polymers, the main application, historical development of synthetic organic polymers. Production of monomers from petrochemicals and renewable raw materials.<br>2nd week: Polymerization reactions. Characteristics of step-growth and chain reactions. Step-growth polymerization. Mechanism. Kinetics of catalyzed polymerization. Kinetics of uncatalysed polymerization. Analytical expressions for the reaction rate.<br>3rd week: Dependence of the average degree of polymerization and the average molecular weight on duration of polymerization. The definition of average molecular weight. Flory's the most probable molecular weight distribution (numerical and weight average).<br>4th week: Modified Carothers equation: the average functionality of the critical conversion. Carothers equation for non-stoichiometric ratio of bifunctional monomers. Technical design of step-growth polymerization (bulk polymerization, the interfacial polymerization). | | | | | |

<table>
<tr><td></td><td colspan="6">5th week: Examples of thermoplastic step-growth polymers: polyesters, polycarbonates, polyamides (aliphatic and aromatic), polyimides, polysulfones, poly (phenylene oxide), polyurethanes, polysiloxanes. The theory of crosslinking.<br>6th week: Examples of thermosetting step-growth polymers: unsaturated polyesters and modified alkyd resins, phenoly formaldehyde polymers, epoxy resins). Chain polymerization - characteristics.<br>7th week: The radical chain polymerization, initiator types. The mechanism of polymerization (initiation, propagation and termination). Rate of polymerization (analytical expression). The kinetic chain length. Average degree of polymerization and the average molecular weight. The distribution of molecular weights.<br>8th week: The ionic chain polymerization. Anionic polymerization: initiators, mechanism, rate of polymerization, the kinetic chain length, average degree of polymerization, molecular weight distribution. Anionic polymerization: initiators, mechanism, rate of polymerization, the kinetic chain length, average degree of polymerization, molecular weight distribution<br>9th week: Effect of temperature on the rate of polymerization. Stereospecific polymerization. Ziegler-Natta catalyst. The mechanism of the stereospecific polymerization. Basic characteristics of stereoregular polymers. Metallocenes. Polymerization with metallocene catalysts.<br>10th week: Examples of polymers obtained by chain polymerizacion: polyethylene, poly(vinyl chloride), polypropylene, polystyrene, poly(methyl methacrylate), polyacrylonitrile, poly(tetrafluoroethylene)...<br>11th week: Copolymerization. Types of copolymers. Copolymerization equation. Experimental determination of reactivity ratios (Lewis Maya method). Allfrey-Price method of determining the individual reactivity of monomers in copolymerization. Distribution and average length of the sequences in the copolymer.<br>12th week: Technical Design polymerization process. Homogeneous polymerization in bulk, in solution. Heterogeneous polymerization in bulk, in solution and in suspension.<br>13th week: Polymerization in supercritical $CO_2$. Industrial production of widely available polymers: low density polyethylene and high density polyethylene. Polymerization of ethylene in suspension, in solution and gass phase.<br>14th week: Borstar bimodal process. Poly (vinyl chloride): production and application. Polypropylene and polystyrene (technical performance of the polymerization process).<br>15th week: The final lecture, discussion, comments, conclusions.<br><br>Laboratory exercises:<br>Exercise 1. Synthesis of phenol-formaldehyde resin.<br>Exercise 2. Polyesterification of adipic acid with diethylene glycol.<br>Exercise 3. Synthesis of modified alkyd resin.<br>Exercise 4. Suspension polymerization of styrene.<br>Exercise 5. Emulsion polymerization of vinyl acetate.<br>Exercise 6. Preparation of poly(vinyl alcohol) by alcoholysis of poly(vinyl acetate).<br>Exercise 7. Synthesis of polyamide 610 by interfacial polymerization.</td></tr>
<tr><td>Format of instruction</td><td colspan="3">x lectures<br>x seminars and workshops<br>□exercises<br>□on linein entirety<br>□partial e-learning<br>□field work</td><td colspan="3">□independent assignments<br>x multimedia<br>x laboratory<br>□work with mentor<br>□ (other)</td></tr>
<tr><td>Student responsibilities</td><td colspan="6">Attending lectures and seminars in the 80% amount and laboratory exercises in the 100% amount of the total number of lessons.</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></td><td>Practical training (analysis of data)</td><td>0.3</td></tr>
<tr><td>Experimental work</td><td>1.5</td><td>Report</td><td>0.4</td><td>Preparation for exp. work</td><td>0.7</td></tr>
</table>

| | | | | | | |
|---|---|---|---|---|---|---|
| *activity so that the total number of ECTS credits is equal to the ECTS value of the course)* | Essay | | Seminar essay | | (Other) | |
| | Tests | 1.2 | Oral exam | 1.2 | (Other) | |
| | Written exam | 1.2 | Project | | (Other) | |

| | | | |
|---|---|---|---|
| Grading and evaluating student work in class and at the final exam | Continuous evaluation:<br>The entire exam can be passed over three colloquium during the semester. Pass threshold for each colloquium is 50%. Each colloquium participates with 25% in a final grade. Laboratory exercises (50-100% success) participate with 20% in a final grade, while attending lectures in 80-100% amount is 5% of a final grade.<br>Final evaluation:<br>Two passed colloquium (previous activity) is recognized as 20% of a final grade. The remaining part is taken on written and oral exam at prescribed examination terms. Written exam accounts for 30%, oral exam for 40%, while laboratory exercises account for 20% of a final grade, respectively.<br>One passed colloquium (previous activity) is recognized as 10% of a final grade. The remaining part is taken on written and oral exam at prescribed examination terms. Written exam accounts for 30%, oral exam for 40%, while laboratory exercises account for 20% of a final grade, respectively.<br>Students who did not take or pass colloquiums take written and oral exam at prescribed examination terms. Passing threshold is 50%. Written exam accounts for 40%, oral exam for 40%, while laboratory exercises account for 20% of a final grade, respectively.<br>Grades definitions and percentages: sufficient (50-61%), good (62-74%), very good (75-87%), excellent (88-100%). | | |
| Required literature (available in the library and via other media) | **Title** | **Number of copies in the library** | **Availability via other media** |
| | H. Ulrich, Introduction to Industrial Polymers, Hanser Publishers, Munich, 1992.; | 1 | |
| | A. G. Odian, Principles of Polymerization, 4th edition, John Wiley & Sons, Inc., New York, 2004. | 1 | |
| | Z. Janović, Polimerizacije i polimeri, Kemija u industriji, Zagreb, 1997.; | 2 | |
| | F. Rodriguez, Polymer Science and Technology, Taylor and Francis, Philadelphia, 1996. | 1 | |
| Optional literature (at the time of submission of study programme proposal) | H. Ulrich, Row Materials for Industrial Polymers, Hanser Publishers, Vienna 1988.; A. Ravve, Principles of Polymer Chemistry, Plenum Press, London, 1995.; G.M. Wells, Handbook of Petrochemicals and Processes, Ashgate Publishing Ltd, Aldershot, 1999. | | |
| 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) | | | |

# Structure and Properties of Polymers

| | |
|---|---|
| **NAME OF THE COURSE** | **Structure and Properties of Polymers** |

<table>
<tr><td>Code</td><td>KTB201</td><td>Year of study</td><td colspan="4">2.</td></tr>
<tr><td>Course teacher</td><td>PhD, Matko Erceg, associate prof.</td><td>Credits (ECTS)</td><td colspan="4">5.0</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></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">- acquire knowledge about the structural properties of the polymer<br>- ability to connect the structure with properties of polymers<br>- understanding the mechanisms of polymer degradation<br>- ability to analyze polymers using modern instrumental techniques</td></tr>
<tr><td>Course enrolment requirements and entry competences required for the course</td><td colspan="6">None</td></tr>
<tr><td>Learning outcomes expected at the level of the course (4 to 10 learning outcomes)</td><td colspan="6">After passing the exam, the student is expected to be able to:<br>- distinguish different types of polymers<br>- explain the specific structure of the polymer<br>- argue correlation of structure and properties of polymers<br>- describe the basic properties of polymers (mechanical, thermal, optical, electrical)<br>- carry out tests of thermal, mechanical and structural properties of polymers<br>- describe the mechanisms of polymer degradation<br>- dse the acquired knowledge in engineering practice</td></tr>
<tr><td>Course content broken down in detail by weekly class schedule (syllabus)</td><td colspan="6">1st week: Introduction. Basic concepts and terminology. Types of polymers: thermoplastics, thermosets, elastomers, thermoplastic elastomers.<br>2nd week: The structure of polymers: the size of macromolecules, molecular weight, homopolymers, copolymers, the configuration of macromolecules.<br>3rd week: The conformation of macromolecules. Morphology of macromeolecular systems.<br>4th week: Phase states and physical states of polymers. Thermomechanical curve. Polymer liquid crystals.<br>5th week: Differential scanning calorimetry. Transition temperatures: the glass transition temperature, the melting temperature, the crystallization temperature.<br>6th week: Thermal degradation of polymers. Thermogravimetric analysis.<br>7th week: UV/VIS spectroscopy. Oxidative degradation. Ozonation.<br>8th week: Photochemical and photooxidative degradation. Ionizing degradation.<br>9th week: Chemical and mechanical degradation. Aging. Biodegradation.<br>10th week: The thermal stability and combustibility of polymers.<br>11th week: The permeability of polymers. Thermal properties of polymers.<br>12th week: The mechanical properties of polymers.<br>13th week: The optical properties of polymers. The solubility of polymers.<br>14th week: Electrical properties of polymers. Conductive polymers.<br>15th week: Infrared Spectroscopy.<br><br>Exercises: Identification of polymers by primary tests, Viscometric determination of molecular weight of polymers, Identification of polymers and additives by infrared spectroscopy, Determination of glass transition temperature by thermomechanical method, Determination of the glass transition and the melting temperature by differential scanning calorimetry, Analysis of structure of degraded poly(vinyl chloride) by UV/VIS spectroscopy, Thermogravimetric analysis of polymers, Determination of hardness - Shore hardness.</td></tr>
<tr><td>Format of</td><td colspan="3">x lectures</td><td colspan="3">□independent assignments</td></tr>
</table>

| | | |
|---|---|---|
| instruction | □seminars and workshops<br>□exercises<br>□*on line*in entirety<br>□partial e-learning<br>□field work | x multimedia<br>x laboratory<br>□work with mentor<br>□ (other) |
| Student responsibilities | Attending lectures in the 80% amount and laboratory exercises in the 100% amount of the total number of lessons | |

| 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 | 1.0 | Research | | Practical training | |
| | Experimental work | 1.0 | Report | 0.2 | (Other) | 0.4 |
| | Essay | | Seminar essay | | (Other) | |
| | Tests | 0.8 | Oral exam | 0.8 | (Other) | |
| | Written exam | 0.8 | Project | | (Other) | |

| | |
|---|---|
| Grading and evaluating student work in class and at the final exam | Continuous evaluation:<br>The entire exam can be passed over two colloquium during the semester. Pass threshold for each colloquium is 50%. Each colloquium participates with 35% in a final grade. Laboratory exercises (50-100% success) participate with 20% in a final grade, while attending lectures in 80-100% amount is 10% of a final grade.<br>Final evaluation:<br>One passed colloquium (previous activity) is recognized as 10% of a final grade. The remaining part is taken on written and oral exam at prescribed examination terms. Written exam accounts for 30%, oral exam for 40%, while laboratory exercises account for 20% of a final grade, respectively.<br>Students who did not take or pass colloquiums take written and oral exam at prescribed examination terms. Passing threshold is 50%. Written exam accounts for 40%, oral exam for 40%, while laboratory exercises account for 20% of a final grade, respectively.<br>Grades definitions and percentages: sufficient (50-61%), good (62-74%), very good (75-87%), excellent (88-100%). |

| | **Title** | **Number of copies in the library** | **Availability via other media** |
|---|---|---|---|
| Required literature (available in the library and via other media) | T. Kovačić, Struktura i svojstva polimera, Faculty of Chemistry and Technology, Split, 2010. | 5 | Web knjižnica KTF-a |
| | C. E. Carraher, Jr., Seymour/Carracher's Polymer Chemistry, 4thEdition, Marcel Dekker Inc., New York, 1996. | 1 | |
| | I. M. Campbel, Introduction to Synthetic polymers, Oxford University Press, Oxford, 2000. | 1 | - |
| | D. J. David, A. Misra, Relating Materials Properties to Structure, Technomic Publishing Co., Lancaster, 1999. | 1 | - |
| | P. J. Haines, Thermal Methods of Analysis, Principles, Application and Problems, Blackie Academic &Professional, Glasgow, 1995. | 1 | - |

| | |
|---|---|
| Optional literature (at the time of submission of study programme proposal) | Z. Janović, Polimerizacije i polimeri, Hrvatsko društvo kemijskih inženjera i tehnologa, Zagreb, 1997.; D. W. van Krevelen, Properties of Polymers, Elsevier Science B. V., Amsterdam, 1997. |
| Quality assurance methods that ensure the | Quality assurance will be performed at three levels: (1) University Level, (2) Faculty Level by Quality Control Committee, (3) Lecturer's Level. |

| | |
|---|---|
| acquisition of exit competences | |
| Other (as the proposer wishes to add) | |

# Polymers Characterization

| NAME OF THE COURSE | Polymers Characterization | | | | | |
|---|---|---|---|---|---|---|
| Code | KTB202 | Year of study | 2 | | | |
| Course teacher | PhD, Nataša Stipanelov Vrandečić, 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 | To provide an understanding of thermodynamic and kinetic behavior of polymers, polymer solutions and melts as a base for their characterization. |
| 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 successfully passed exam student should be able to:<br>- describe specific characteristics of polymers, polymer solutions and melts<br>- describe relation between structure and properties of polymers<br>- characterise polymers by selected analytical techniques<br>- determine thermal characteristics of polymer<br>- perform complex experiment in laboratory and to interpret collected data<br>- participate in team work and to present results of investigation |
| Course content broken down in detail by weekly class schedule (syllabus) | 1st week: Introduction. Statistics of polymer chain.<br>2nd week: Conformation of polymer molecules in dilute solution, distribution function.<br>3rd week: Polymer solutions: swelling and solution of polymers, solubility parameters.<br>4th week: Statistical thermodynamics of polymer solutions.<br>5th week: Theory of dilute polymer solutions.<br>6th week: Phase equlibrium in polymer systems: binary systems, ternary systems<br>7th week: Theory of fractionation. Methods of fractionation<br>8th week: Repetition and first test.<br>9th week: Polydispersity of polymers and its determination<br>10th week: Methods of determination of the average molecular masses and average dimensions of polymeric coils: osmometry, light-scattering<br>11th week: Diffusion and ultracentrifugation, viscometry<br>12th week: Flow of concentrated polymer solutions and polymer melts: rheological methods, flow curves<br>13th week: The relation between flow and molecular parameters, relation between flow and polymeric melts temperature<br>14th week: Viscosity of concentrated polymeric solutions |

<table>
<tr><td></td><td colspan="6">15th week: Repetition and second test.<br><br>Laboratory exercises:<br>1. Swelling of polymeric materials<br>2. Fractionation of polymer by fractional precipitation method<br>3. Turbidimetric titration<br>4. Determination of molecular mass by viscometry<br>5. Determination of viscosity of concentrated polymer solutions by rotational viscometer<br>6. Determination of thermal characteristics of polymers</td></tr>
<tr><td>Format of instruction</td><td colspan="3">X lectures<br>□ seminars and workshops<br>x exercises<br>□ on line in entirety<br>□ partial e-learning<br>□ field work</td><td colspan="3">x independent assignments<br>x multimedia<br>X laboratory<br>□ work with mentor<br>□ (other)</td></tr>
<tr><td>Student responsibilities</td><td colspan="6">Lecture attendance: 80 %. Laboratory exercises attendance: 100 %. The preparation and presentation of seminar essay (team work)</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>1,00</td><td>Report</td><td>0,20</td><td>Exercises tests study (Other)</td><td></td></tr>
<tr><td>Essay</td><td></td><td>Seminar essay</td><td>1.00</td><td>Field work (Other)</td><td>0.5</td></tr>
<tr><td>Tests</td><td>2,80</td><td>Oral exam</td><td>(1,40)</td><td>(Other)</td><td></td></tr>
<tr><td>Written exam</td><td>(1,40)</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">CONTINUOUS EVALUATION<br>The complete exam can be passed through two partial tests during semester.<br>Attendance on lectures, $A_1$(successfulness =70 -100 %), share in grade, $k_1$ =0,10<br>Laboratory exercises, $A_2$(successfulness =60 -100 %), share in grade, $k_2$ =0,20<br>1st test, $A_3$ (successfulness =60 -100 %), share in grade, $k_3$ =0,35<br>2nd test, $A_4$ (successfulness =60 -100 %), share in grade, $k_4$ =0,35<br><br>GRADE (%) = $0,10A_1+0,20A_2 + 0,35A_3+ 0,35A_4$<br><br>FINAL EVALUATION<br>Students who did not take or pass partial tests have to attend to written and oral exam in the regular exam periods.<br>Activities $A_1$ and $A_2$ are evaluated in the same way as indicated above.<br>Written exam, $A_5$ (successfulness =60 -100 %), share in grade, $k_5$ =0,20<br>Oral exam, $A_6$ (successfulness =60 -100 %), share in grade, $k_6$ =0,40<br>GRADE (%) = $0,10A_1+0,15A_2 + 0,20A_5 + 0,40A_6$<br><br>FINAL GRADE: successful (50% – 61 %), good (62% – 74 %), very good (75% – 87 %), excellent (88% – 100 %).<br><br>In the case that student passed only one test during continuous evaluation, he/she have to attend to written and oral exam in the regular exam periods. The passed test will be recognized by the end of the academic year as a part of the written exam.</td></tr>
<tr><td>Required literature</td><td colspan="4">Title</td><td>Number of</td><td>Availability via</td></tr>
</table>

| | | | |
|---|---|---|---|
| (available in the library and via other media) | | **copies in the library** | **other media** |
| | 1. N. Stipanelov Vrandečić: Karakterizacija polimera, recenzirani nastavni materijali, Kemijsko-tehnološki fakultet, Split, 2012. | 1 | web library KTF |
| | I. Klarić: Karakterizacija polimera, Interna skripta, Kemijsko-tehnološki fakultet, Split, 2010. | 1 | web library KTF |
| | | | |
| Optional literature (at the time of submission of study programme proposal) | L.H. Sperling, Introduction to Physical Polymer Science, 2nd Edition, John Wiley & Sons, Inc., 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) | | | |

# Polymer Blends and Composites

| **NAME OF THE COURSE** | **Polymer Blends and Composites** | | | | | |
|---|---|---|---|---|---|---|
| Code | KTB203 | Year of study | 2nd | | | |
| Course teacher | PhD, Branka Andričić, prof. | Credits (ECTS) | 5.0 | | | |
| Associate teachers | | Type of instruction (number of hours) | L | S | E | F |
| | | | 30 | | 25 | 5 |
| Status of the course | Elective | Percentage of application of e-learning | | | | |
| **COURSE DESCRIPTION** | | | | | | |
| Course objectives | Gaining of the basic theoretical and practical knowledge on multi-component systems, ie. polymer blends and composites. Correlation of composition, structure and properties of material. | | | | | |
| 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 deformational states of polymers and describe thermomechanical curve<br>- describe phase diagrams of polymer blends<br>- be able to recognize miscible and immiscible polymer blends based on Tg measurements<br>- be acquainted with methods for polymer blends preparation<br>- distinguish the components of polymer blends and polymer composites<br>- be able to explain the differences between microcomposites and nanocomposites<br>- explain the role of fillers and reinforcements in polymer composites | | | | | |
| Course content | 1st week: Historical overview and world consumption of polymeric materials. Basic | | | | | |

<table>
<tr><td>broken down in detail by weekly class schedule (syllabus)</td><td colspan="6">terms and classification of polymers.<br>2nd week: Molecular and supermolecular structure of polymers. Physical and deformational states of polymers. Thermomechanical curve.<br>3rd week: Reasons for preparing blends and composites. Design of polymer blends. Thermodinamic aspect of miscibility.<br>4th week: Phase diagrams. Prediction of thermodynamic properties (theories of mixing). Influence of molecular weight on polymers miscibility.<br>5th week: Determination (estimation) of polymers miscibility (methods). Properties and morphology of miscible polymer blends.<br>6th week: Properties and morphology of immiscible polymer blends. Compatibilization methods. Preparation of polymer blends.<br>7th week: Commercial polymer blends. Blends with LCP.<br>Ponavljanje. First test.<br>8th week: Polymer composites, classification. Fillers and reinforcements in polymer composites.<br>9th week: Particle reinforced polymer composites.<br>10th week: Fibre reinforced composites. Types of fibre orientation.<br>11th week: Types of fibres and mechanical properties. Prepregs.<br>12th week: Matrix-reinforcement boundary surface and compatibilization of matrix and reinforcement/filler.<br>13th week: Polymer nanocomposites. Composites with biodegradable components.<br>14th week: Structural composites: basic components and adhesives. Preparation methods of structural composites.<br>15th week: An Overview. Second test.<br><br>Laboratory exercises:<br>1. TG analysis of composite materials<br>2. DSC analysis of polymer blends<br>3. Identification of polymers using FT-IR spectroscopy<br>4. Separation and identification of additives in polymeric material<br>5. Modification of PVC and material preparation on an extruder</td></tr>
<tr><td>Format of instruction</td><td colspan="3">X lectures<br>□ seminars and workshops<br>□ exercises<br>□ on line in entirety<br>□ partial e-learning<br>X field work</td><td colspan="3">□ independent assignments<br>X multimedia<br>X laboratory<br>□ work with mentor<br>□ (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>0.5</td></tr>
<tr><td>Experimental work</td><td>0.8</td><td>Report</td><td></td><td>Tests before experimental work</td><td>0.5</td></tr>
<tr><td>Essay</td><td></td><td>Seminar essay</td><td></td><td>Field work</td><td>0.2</td></tr>
<tr><td>Tests</td><td>0.8</td><td>Oral exam</td><td>0.4</td><td>(Other)</td><td></td></tr>
<tr><td>Written exam</td><td>0.8</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 complete exam can be passed through two tests during semester. The passing score is 60 % and the fraction of each test is 35%. In the final grade laboratory exercises has fraction of 30%. In the exam period the student has to attend to</td></tr>
</table>

| | | | |
|---|---|---|---|
| the final exam | written and oral exam (passing score is 60%). Written exam is 35% and oral exam is 35%.<br>Grades: successful (60% – 70%), good (71% – 80%), very good (81% – 90%), excellent (91% – 100%). | | |
| Required literature (available in the library and via other media) | **Title** | **Number of copies in the library** | **Availability via other media** |
| | L. A. Utracki, Polymer Alloys and Blends, Hanser Publ., Munich, 1989;<br>D. J. David, A. Misra, Relating Materials Properties and Structure, Technomic Publ. Co. Basel, 1999. | 1<br>1 | |
| Optional literature (at the time of submission of study programme proposal) | M.J. Folkes, P.S. Hope, Polymer Blends and Alloys, Blackie Academic & Professional, London, 1995;<br>S. Datta, D.J. Lohse, Polymeric Compatibilizers, Hanser Publ., Munich,1996.. | | |
| 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) | | | |

# Polymer Processing

| **NAME OF THE COURSE** | **Polymer Processing** | | | | | |
|---|---|---|---|---|---|---|
| Code | KTB204 | Year of study | 2. | | | |
| Course teacher | PhD, Matko Erceg, associate 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 | - Understanding the modern processing of polymers<br>- Understanding the modern methods of polymer waste recovery<br>- Implementation of the adopted knowledge in finding optimal solutions in the processing and recovery of polymers | | | | | |
| 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 passing the exam, the student is expected to be able to:<br>- identify and compare the properties and behavior of the polymer in processing and application<br>- explain the importance of polymer additives<br>- separate and identify additives polymers<br>- describe and select proper procedure for polymer processing | | | | | |

<table>
<tr><td></td><td colspan="6">- argue selection of the optimal recovery of waste<br>- argue the importance of polymers in modern society</td></tr>
<tr><td>Course content broken down in detail by weekly class schedule (syllabus)</td><td colspan="6">1st week: Historical development of processes for production of polymer products. Croatian plastics industry. Basic concepts, nomenclature of polymers.<br>2nd week: Types of polymers: thermoplastics, thermosets, elastomers, thermoplastic elastomers. Systematization of polymer processing. Phase and the physical states of the polymers.<br>3rd week: Mechanical and thermal properties of polymers.<br>4th week: Rheological properties of polymers.<br>5th week: Additives to polymers. Mixing.<br>6th week: Continuous primary shaping processes: calendering, continuous coating.<br>7th week: Extrusion<br>8th week: Discontinuous primary shaping processes: casting, sintering, compression molding, transfer molding.<br>9th week: Injection molding of polymers.<br>10th week: Specific injection molding procedures (gas assisted injection moulding, inserts in plastic mouldings, structural foam, pultrusion).<br>11th week: Secondary shaping procedures: warm and cold secondary shaping, blowing, drawing, shrinkage.<br>12th week: Extrusion and injection blow molding. Production of foamed and reinforced polymer products (laminating, winding, spraying, pultrusion).<br>13th week: Finishing: particle separation, bonding, welding. Surface treatment.<br>14th week: Coating other materials with polymers. Recovery of plastic waste.<br>15th week: Recovery of plastic waste (continued). Final comments, conclusions.<br><br>Exercises: Modification of the properties of polymer by additives, Separation and identification of additives in polymer materials, Preparation of polymer composites and nanocomposites, Determination of oxidation induction time and oxidation induction temperature, Effect of repeated mechanical recycling on the thermal properties of the polymer.<br>Field work: Visit to factories AD Plastik Inc. Solin and Fornix Ltd., Dugi Rat.</td></tr>
<tr><td>Format of instruction</td><td colspan="3">x lectures<br>□seminars and workshops<br>□exercises<br>□on linein entirety<br>□partial e-learning<br>x field work</td><td colspan="3">□independent assignments<br>x multimedia<br>x laboratory<br>□work with mentor<br>□ (other)</td></tr>
<tr><td>Student responsibilities</td><td colspan="6">Attending lectures in the 80% amount, and laboratory exercises in the 100% amount of the total number of lessons</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>0.7</td><td>Report</td><td>0.2</td><td>Preparation for exp. work</td><td>0.4</td></tr>
<tr><td>Essay</td><td></td><td>Seminar essay</td><td></td><td>Field work</td><td>0.3</td></tr>
<tr><td>Tests</td><td>0.8</td><td>Oral exam</td><td>0.8</td><td>(Other)</td><td></td></tr>
<tr><td>Written exam</td><td>0.8</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">Continuous evaluation:<br>The entire exam can be passed over two colloquium during the semester. Pass threshold for each colloquium is 50%. Each colloquium participates with 35% in a final grade. Laboratory exercises (50-100% success) participate with 20% in a final grade, while attending lectures in 80-100% amount is 10% of a final grade.<br>Final evaluation:<br>One passed colloquium (previous activity) is recognized as 10% of a final grade. The remaining part is taken on written and oral exam at prescribed examination terms. Written exam accounts for 30%, oral exam for 40%, while laboratory</td></tr>
</table>

| | | | |
|---|---|---|---|
| | exercises account for 20% of a final grade, respectively.<br>Students who did not take or pass colloquiums take written and oral exam at prescribed examination terms. Passing threshold is 50%. Written exam accounts for 40%, oral exam for 40%, while laboratory exercises account for 20% of a final grade, respectively.<br>Grades definitions and percentages: sufficient (50-61%), good (62-74%), very good (75-87%), excellent (88-100%). | | |
| Required literature (available in the library and via other media) | **Title** | **Number of copies in the library** | **Availability via other media** |
| | A. Rogić, I. Čatić, D. Godec, Polimeri i polimerne tvorevine, Društvo za plastiku i gumu, Zagreb, 2008. | 2 | |
| | A. Azapagic, A. Emsley, I. Hamerton, Polymers, The Environment and Sustainable Development, Wiley, 2003. | 1 | |
| | M. Šercer, D. Opsenica, G. Barić, Oporaba plastike i gume, mtg topograf d.o.o., Zagreb, 2000. | 1 | |
| | J. Scheirs, Polymer Recycling: Science, Technology and Applications, John Wiley&Sons, Chichester, 1998. | 1 | |
| Optional literature (at the time of submission of study programme proposal) | I. Čatić, F. Johannaber, Injekcijsko prešanje polimera i ostalih materijala, Društvo za plastiku i gumu, Zagreb, 2004.; H. F. Gilles, Jr., J. R. Wagner, Jr., E. M. Mount, III., Extrusion: The Definitive Processing Guide and Handbook, William Andrew, Inc., New York, 2005.; L. Lundquist, Y. Leterrier, P. Sunderland, J.E. Manson, Life Cycle Engineering of Plastics, Elsevier, Oxford, 2000.; A. L. Andrady, Plastics and the Environment, Wiley-Interscience 2003.; Z. Janović, Polimerizacije i polimeri, Hrvatsko društvo kemijskih inženjera i tehnologa, Zagreb, 1997. | | |
| 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) | | | |

# Coatings

| **NAME OF THE COURSE** | **Coatings** | | | | | |
|---|---|---|---|---|---|---|
| Code | KTB206 | Year of study | 2nd | | | |
| Course teacher | PhD, Nataša Stipanelov Vrandečić, 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 | Gaining the basic theoretical and practical knowledge on structure and characteristics of paint and surface coatings, industrial paint-making processes, as well as on application of coatings in different fields. | | | | | |
| Course enrolment requirements and | | | | | | |

<table>
<tr><td>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 the successfully passed exam student should be able to:<br>- define types and functions of coatings<br>- list components of coatings and to explain its characteristics<br>- describe manufacturing process of coatings<br>- explain importance of rheological characteristics of coatings<br>- perform experiment and measurement in laboratory and to interpret collected data<br>- participate in team work and to present results of project</td></tr>
<tr><td>Course content broken down in detail by weekly class schedule (syllabus)</td><td colspan="6">1st week: Introduction: characteristics, definitions and historical development of coatings,<br>2nd week: Classification and application of coatings. Composition of coating and role of basic components.<br>3rd week: Binders: Natural polymers, Oils and fatty acids, Oleoresinous media<br>4th week: Alkyd resins, Polyurethane and urethane alkyd,<br>5th week: Acrylic polymers, Amino resins<br>6th week: Phenol-formaldehyde resins, Epoxy resins, Polyester resins<br>7th week: Vinyl polymers, Silicone resins, Chlorinated rubber<br>8th week: Emulsion and dispersion polymers, Non-aqueous dispersion polymers, Water-borne systems<br>Written test (first)<br>9th week: Resins for electrodeposition, High solids coatings, Radiation-curing coatings, Powder-coatings compositions.<br>10th week: Pigments: required qualities of pigments, pigment classification, particulate nature of pigments and the dispersion process, corrosion-inhibiting pigments.<br>11th week: Solvents and thinners, solvent power, solubility parameters, solvent effect on viscosity, evaporation solvent from coatings<br>12th week: Additives for coatings<br>13th week: Industrial paint-making process, methods of dispersion and machinery<br>14th week: Rheological properties of coatings: definitions, solution and dispersion viscosity, viscosity of polymer solutions,<br>15th week: Rheology of coatings during manufacture, storage and application, Methods of coating application.<br>Written test (second)<br><br>Laboratory exercise:<br>1. Synthesis of polymer suitable as resin for organic coating; Analysis of raw materials and product<br>2. Analysis of alkyde and acrylic coatings by FT-IR spectroscopy<br>3. Analysis of coating by DSC<br>4. Determination of viscosity of coatings<br>5. Determination of relative density by areometer<br>6. Determination of volatile matter in coatings<br>7. Determination of thermal stability of coatings by TG</td></tr>
<tr><td>Format of instruction</td><td colspan="3">xlectures<br>□seminars and workshops<br>xexercises<br>□on linein entirety<br>□partial e-learning<br>xfield work</td><td colspan="3">□independent assignments<br>xmultimedia<br>xlaboratory<br>□work with mentor<br>□ (other)</td></tr>
<tr><td>Studentresponsibilities</td><td colspan="6"></td></tr>
<tr><td>Screening student work(name the</td><td>Class attendance</td><td>1.00</td><td>Research</td><td></td><td>Practical training</td><td></td></tr>
</table>

| | | | | | | |
|---|---|---|---|---|---|---|
| *proportion of ECTS credits for eachactivity so that the total number of ECTS credits is equal to the ECTS value of the course)* | Experimental work | 0,80 | Report | 0,20 | (Other) | |
| | Essay | | Seminar essay | | (Other) | |
| | Tests | 3.00 | Oral exam | (1.50) | (Other) | |
| | Written exam | (1.50) | Project | | (Other) | |

**Grading and evaluating student work in class and at the final exam**

CONTINUOUS EVALUATION
The complete exam can be passed through two partial tests during semester.
Attendance on lectures, $A_1$(successfulness =70 -100 %), share in grade, $k_1$ =0,10
Laboratory exercises, $A_2$(successfulness =60 -100 %), share in grade, $k_2$ =0,20
1st test, $A_3$ (successfulness =60 -100 %), share in grade, $k_3$ =0,35
2nd test, $A_4$ (successfulness =60 -100 %), share in grade, $k_4$ =0,35

GRADE (%) = $0,10A_1+0,20A_2 + 0,35A_3+ 0,35A_4$

FINAL EVALUATION
Students who did not take or pass partial tests have to attend to written and oral exam in the regular exam periods.
Activities A1 and A2 are evaluated in the same way as indicated above.
Written exam, $A_5$ (successfulness =60 -100 %), share in grade, $k_5$ =0,20
Oral exam, $A_6$ (successfulness =60 -100 %), share in grade, $k_6$ =0,40
GRADE (%) = $0,10A_1+0,15A_2 + 0,20A_5 + 0,40A_6$

FINAL GRADE: successful (60% – 70 %), good (71% – 80 %), very good (81% – 90 %), excellent (91% – 100 %).

In the case that student passed only one test during continuous evaluation, he/she have to attend to written and oral exam in the regular exam periods. The passed test will be recognized by the end of the academic year as a part of the written exam.

**Required literature (available in the library and via other media)**

| Title | Number of copies in the library | Availability via other media |
|---|---|---|
| N. Stipanelov Vrandečić, Coatings, (lecturers handouts) | | CD-ROM |
| I R. Lambourne and T.A. Strivens (Edit.), Paint and surface coatings, Woodhead publishing Ltd., Cambridge, 1999. | 1 | |
| D, Stoye and W. Freitag, Resins for Coatings, Hanser Publisher, Cincinnati, 1996. | 1 | |

**Optional literature (at the time of submission of study programme proposal)**

Z. Janović: Polimerizacije i polimeri, Hrvatsko društvo kemijskih inženjera i tehnologa , Zagreb, 1997

**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) | |

# Glass and Ceramics

| **NAME OF THE COURSE** | **Glass and Ceramics** | | | | | |
|---|---|---|---|---|---|---|
| Code | KTB207 | Year of study | 2nd | | | |
| Course teacher | PhD, Jelica Zelić, prof. | Credits (ECTS) | 5.0 | | | |
| Associate teachers | PhD, Mario N. Mužek, assistant | Type of instruction (number of hours) | L | S | E | F |
| | | | 30 | | 20 | 10 |
| Status of the course | Elective | Percentage of application of e-learning | - | | | |
| **COURSE DESCRIPTION** | | | | | | |
| Course objectives | Qualifying students to adopt and apply basic processes in glass and ceramic production with chemical engineering aspect of the production, control and application of comercial ceramics. | | | | | |
| 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:<br>1. Classify the ceramic materials due to their properties and applications.<br>2. Assess the interconnectedness of microstructure, properties and production of tradicional and advanced ceramics.<br>3. Explain the properties and behavior of clay minerals in a water-clay depending on the structure of clay minerals.<br>4. Explain the difference in the structure of ceramics depending on the processes of drying and firing (sintering).<br>5. Classify the technical glass.<br>6. Explain the properties of molten glass and the reason for the occurrence of defects in the glass.<br>7. Assess the impact of the environment (weathering) on the durability of technical glass.<br>8. Assess the quality of raw materials and finished products using chemical and physical parameters.<br>9. Choosing the correct engineering approach in the selection of raw materials and process parameters in the production of glass and ceramics starting from the knowledge acquired. | | | | | |
| Course content broken down in detail by weekly class schedule (syllabus) | 1st week: Introduction. Historical overview, potential and meaning of glass and ceramic industries.<br>2nd week: Definition, composition, and structure of technical (commercial) glass. Classification of glass.<br>3rd week: The basic processes and the manufacture of glass. Raw materials and basic requirements for quality raw materials. The $Na_2O$-$SiO_2$ system.<br>4th week: Calculation and preparation of raw material mixture for the manufacture of colourless and coloured (green) glass.<br>5th week: Glass melting processes. Basic operations and devices. Furnaces. The properties of glass melts. Defects in glass. Crystallization. Devitrification. Viscosity.<br>6th week: Glass forming operations (blowing, rolling, drawing, pressing). Devices.<br>7th week: Cooling and surface treatment of the glass. Glass dyeing. The stained glass. Glass-ceramics. | | | | | |

<table>
<tr><td></td><td colspan="6">8th week: The written knowledge tests (I Colloquium)<br>9th week: Definition and classification of ceramics. Traditional and advanced ceramic materials.<br>10th week: Natural mineral raw materials. Synthesis of ceramic powders. Phase diagrams of systems important for ceramics.<br>11th week: Structure and properties of clay minerals. Ion exchange phenomenon clay. The clay-water. Characterization of ceramic slurries (rheology, plasticity, etc..).<br>12th week: Formating processes (slip casting, pressing, jiggering, extrusion, etc..). Drying and firing of crude products. Sintering processes and reactions in the solid state.<br>13th week: Overview of important traditional ceramic materials, their properties and applications. Flow diagrams of production, with special emphasis on the physical and chemical base process, equipment and the environment aspects.<br>14th week: Overview of important advanced ceramic materials, their properties and applications. Flow diagrams of production, with special emphasis on the physical and chemical base processes, equipment and the environment aspects.<br>15th week : The written knowledge tests (II Colloquium).<br><br>EXERCISES:<br>1. Determination of the cation exchange capacity of clays by the ammonium acetate method, and identification of clay minerals.<br>2. Applications of thermal analysis (DTA-TG/DTG) and infrared spectroscopy (FTIR) in the analysis of the clay.<br>3. Determination of the porosity of the sintered ceramic body.<br>4. Manufacturing ceramic vase by slip casting technic in laboratory scale.<br>5. Determination of hydraulic resistance of technical glass.<br>6. Field work - visiting the technological facilities for the production of glass and ceramic products.</td></tr>
<tr><td>Format of instruction</td><td colspan="3">x lectures<br>☐seminars and workshops<br>x exercises<br>☐on linein entirety<br>☐partial e-learning<br>x field work</td><td colspan="3">x independent assignments<br>x multimedia<br>x laboratory<br>☐work with mentor<br>☐ (other)</td></tr>
<tr><td>Student responsibilities</td><td colspan="6">Implementation and analysis of selected processes according to preset conditions. Each student is required to attend laboratory practice and field work (100%). On completion of all exercises the final written exam is obligated.</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>0.5</td><td>Report</td><td>0.5</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>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 colspan="5"></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 (2) exams during the semester. Passing threshold is 60%. Each colloquium in assessing participates with 45%. 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 colloquium (previous activity) is true in the summer examination period with a share of 10% in the assessment. Written exam has a share of 40% and 50% verbal. Students who have not passed the exam by tests take the examination through written and oral exams in the regular examination period. Passing threshold is 60% and the</td></tr>
</table>

| | | | |
|---|---|---|---|
| | examination form to participate in the evaluation by 50%.<br>Rating: 60% -70% - satisfactory, 71% -81% - good, 82% -92% very good, 93% - 100% - excellent. | | |
| Required literature (available in the library and via other media) | **Title** | **Number of copies in the library** | **Availability via other media** |
| | J. Zelić, Practicum in the processes of inorganic industry /Praktikum iz procesa anorganske industrije (in Croatian), Faculty of Chemistry and Technology in Split, Split, 2013 (reviewed and edited teaching materials),<br>http:// www.ktf-split.hr/bib/nm/Procesi _anorganske_ industrije.pdf | 1 | www.ktf-split.hr |
| | J. Zelić, Engineering of Selected Inorganic Materials/ Inženjerstvo odabranih anorganskih materijala (in English), Faculty of Chemistry and Technology in Split, Split, 2013 (reviewed and edited teaching materials),<br>http:// www.ktf-split.hr/bib/nm/Inzenjerstvo _odabranih_ anorganskih_materijala_en.pdf | 1 | www.ktf-split.hr |
| | J. Zelić, Engineering of Selected Inorganic Materials/ Inženjerstvo odabranih anorganskih materijala (in English), Manualia Universitatis Studiorum Spalatensis, University of Split, Split, 2014, peer review. | | |
| Optional literature (at the time of submission of study programme proposal) | 1. R. A. McCauley, Corrosion of Ceramic and Composite Materials, 2nd Ed., CRC Press, 2004, ISBN 0-8247-5366-6.<br>2. M. Tecilazić-Stevanović, Osnovi tehnologije keramike, Univerzitet u Beogradu, Tehnološko-metalurški fakultet, Beograd, 1990., YU ISBN 86-7401-065-2. | | |
| Quality assurance methods that ensure the acquisition of exit competences | Quality of the teaching and learning monitored at the level of the<br>(1) teachers, accepting suggestions of students and colleagues, and<br>(2) Faculty, conducting surveys of students on teaching quality. | | |
| Other (as the proposer wishes to add) | | | |

# New Inorganic Materials

| **NAME OF THE COURSE** | **New Inorganic Materials** | | | | | |
|---|---|---|---|---|---|---|
| **Code** | KTB208 | Year of study | 2nd | | | |
| Course teacher | PhD, Pero Dabić, prof. | Credits (ECTS) | 5.0 | | | |
| Associate teachers | PhD, Damir Barbir, assistant prof. | 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 | - Acquiring knowledge of modern inorganic materials with a description of the technology preparation and opportunities to apply | | | | | |

| | |
|---|---|
| | - To train students for the preparation and evaluation of properties of individual modern inorganic 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 passing the exam, the student is expected to know:<br>- Define and differentiate types of modern inorganic materials<br>- Introduction of new technology for preparing inorganic materials<br>- Characterized nanostructured materials and their use in the new process technologies<br>- Conclude on the importance of the synthesis of new inorganic materials in modern society<br>- Independent synthesis and evaluation of some new properties of inorganic materials |
| Course content broken down in detail by weekly class schedule (syllabus) | Week 1: Introduction, course content, basic definitions, the importance of research material, sustainable technologies and environmental impact<br>Week 2: Metallic glasses, properties, methods of characterization, methods of preparation, the importance and applications<br>Week 3: Glass-ceramics, properties, methods of characterization, methods of preparation, the importance and applications<br>Week 4: Superconducting materials, historical overview of the discovery, properties and characterization, Meissner effect, Josephson effect<br>Week 5: Superconducting materials, the type I and type II, the application of new technologies based on superconducting materials, application examples<br>Week 6: Based on nanotechnology, historical development and achievements, a review of major nanostructured materials<br>Week 7: Written examination - I Colloquium<br>Week 8: Sol-gel technology, a historical overview of the development, the basic concepts, processes the sol-gel methods, operation sequence to obtain silicate glasses<br>Week 9: Sol-gel technology, processes for forming thin films, getting of powder with application<br>Week 10: Sol-gel technology, obtaining of inorganic membranes with nanopore and active catalytic properties, practical examples applied inorganic membrane<br>Week 11: CVD and PECVD technology preparation of nanostructured materials<br>Week 12: Optical fibers and photosensitive inorganic materials, properties, methods preparation and application<br>Week 13: Bioceramics, basic concepts, types, properties, methods of obtaining and application<br>Week 14: Inorganic polymers, basic concepts, types, properties, methods of obtaining and application<br>Week 15: Written examination - II. colloquium<br>Laboratory exercises:<br>Exercise 1 Preparation of silica sol-gel process<br>Exercise 2 Electrochemical method for preparing colloidal silver<br>Exercise 3 Synthesis of colloidal silver by chemical precipitation<br>Exercise 4 Preparation of stable suspensions of nanoparticles of iron oxide – ferrofluid from aqueous solution |

| | |
|---|---|
| | Exercise 5 Preparation of photovoltaic cells based on titanium nanocristallic oxide<br>Exercise 6 The synthesis of zeolite A hydrothermally |
| Format of instruction | **X** lectures<br>☐ seminars and workshops<br>**X** exercises<br>☐ *on line* in entirety<br>☐ partial e-learning<br>☐ field work<br>☐ independent assignments<br>**X** multimedia<br>**X** laboratory<br>☐ work with mentor<br>☐ (other) |
| Student responsibilities | |

| 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 | 2.5 | Research | | Practical training | |
| | Experimental work | 1.0 | Report | 0.2 | Preparation for tests from a lab. exercises | 0.3 |
| | Essay | | Seminar essay | | (Other) | |
| | Tests (Written exam) | 1.0 | Oral exam | | (Other) | |
| | | | Project | | (Other) | |

| | |
|---|---|
| Grading and evaluating student work in class and at the final exam | Continuous evaluation:<br>The entire test can be laid across two exams during the semester. Pass rate threshold is 60%. Each colloquium in assessing participates with 35%. Laboratory exercises participate in the evaluation of 20%. The presence of lectures in 80-100% amount is 10% of the grade.<br>Final evaluation:<br>Students who have passed one colloquium, it is recognized as part of the exam (35% score). The remaining part shall write in regular examination periods. Written exam if not passed a single colloquium has an interest in the evaluation of 70%, while laboratory exercises have share of 20%.<br>Rating: sufficient (50-61%), good (62-74%), very good (75-87%), excellent (88-100%). |

| Required literature (available in the library and via other media) | **Title** | **Number of copies in the library** | **Availability via other media** |
|---|---|---|---|
| | J.K. West, Chemical Processing of Advanced Materials, John Wiley & Sons Inc., New York, 1992. | 1 | |
| | L. Theodore, Nanotechnology-Basic Calculations for Engineers and Scientists, John Wiley & Sons Inc., New York, 2006. | 1 | |
| | J. D. Wright, N.A.J.M. Sommerdijk, Sol-Gel Materijals, Chemistry and Applications, CRC Press, Boca Raton, 2006. | 1 | |
| | M. Aparicio, A. Jitianu, L. C. Klein, Sol-Gel Processing for Conventional and Alternative Energy, Springer, New York, 2012. | 1 | |
| | P. Dabić, Damir, Barbir, Novi anorganski materijali - laboratorijske vježbe, KTF, 2013. | 1 | Web site KTF |
| | | | |
| | | | |
| | | | |

| | |
|---|---|
| Optional literature (at the time of submission of study programme proposal) | R.W. Dull et al., A Teacher`s Guide to Superconductivity for High School Studets, Oak Ridge National Laboratory, WWW-Book, 2001. |
| Quality assurance methods that ensure the acquisition of exit competences | - Methods for Quality assurance will be performed at three levels:<br>(1) University - student survey; (2) Faculty Level by Quality Control Committee of teaching - annual analysis of the performance of examinations;<br>(3) Teacher Level:<br>- Keeping records of class attendance<br>- Monitoring suggestions and reactions of participants during the semester |
| Other (as the proposer wishes to add) | |

# Technology of Building Materials

| **NAME OF THE COURSE** | **Technology of Building Materials** | | | | | | |
|---|---|---|---|---|---|---|---|
| Code | KTB209 | Year of study | 2nd | | | | |
| Course teacher | PhD, Dražan Jozić, associate 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 | Acquiring basic theoretical and practical knowledge about the materials used in construction as well as manufacturing process conditions and preparation of composite materials. Acquiring basic Principe about the methods of characterization and protection of materials in the different environment conditions of use. | | | | | | |
| 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 the student will be able to:<br>1. Prepare samples for standard test procedures in construction materials<br>2. Conduct tests of physical and chemical parameters essential for mineral binders in accordance with the procedures prescribed standard norms for mineral binders<br>3. Assess the type of bonding material suitable for use in a variety of application conditions of building materials<br>4. Prepare mortars and concretes by default specifications<br>5. Evaluate materials suitable for waterproofing | | | | | | |
| Course content broken down in detail by weekly class schedule (syllabus) | 1. Week | L | Description and overview of the course contents. Introductory remarks. The division of materials and their properties, Natural materials, Artificial materials, Materials applied as a structural and / or insulating materials | | | | |
| | | E | | | | | |

| | | | |
|---|---|---|---|
| | 2. Week | L | Physical and mechanical properties of materials, Chemical properties of the material. Checking the quality of the material. |
| | | E | |
| | 3. Week | L | The basics of building materials (stone, wood, building ceramics, glass, metals, polymeric materials). Mineral binders (air and hydraulic binders). Mortars and plasters. |
| | | E | |
| | 4. Week | L | The processes of thermal decomposition of carbonate and technology of production the lime as mineral binder. Standard test methods and characterization of lime |
| | | E | Preparation of lime and measure the reactivity of lime |
| | 5. Week | L | Technology of production of gypsum, and its application as construction materials, Standard methods for testing gypsum for application as construction materials |
| | | E | |
| | 6. Week | L | The First colloquium |
| | | E | |
| | 7. Week | L | Technology for production of Portland cement. Standards and types of the cements, Chemical and mineralogical composition of the cement. |
| | | E | Determination of the specific surface area, density and particle size of the cement as mineral binder. |
| | 8. Week | L | Cement hydration. Cements for special purposes. Mineral admixtures for cement |
| | | E | Determination of normal consistency, time for start and end of setting time. Determination of constancy of cement composites volume. |
| | 9. Week | L | Chemical additives for cement. The quality control of cement. Cement mortars. Examination of physical properties of mortars |
| | | E | Preparation of cement mortars with and without additives, rheological properties of cement composites (mortar, concrete) |
| | 10.Week | L | The technology of preparation of concrete. Test methods for testing production of concrete and produced hardened concrete. Concrete for special purposes. Aggregates for the preparation of concrete, Production of concrete aggregates, The physical properties of aggregates. Methods of testing aggregates. |
| | | E | Testing of the mechanical properties of cement mortars |
| | 11.Week | L | Resistance cements composites in terms of exposure to aggressive environments. Additives used to increase the durability and stability of the composite materials, Methods of monitoring (monitoring) the condition of structures, |
| | | E | Rapid method of measuring the resistance to penetration of cement composites chloride |
| | 12.Week | L | Clay and clay minerals as mineral raw materials for production of building materials. |
| | | E | Determination of capacity exchange cations (CEC value) of clays minarals |
| | 13.Week | L | Materials suitable for thermal and sound insulation used as construction materials |
| | | E | |
| | 14.Week | L | Waterproofing materials used for protection and decoration of constructions. Techniques and methods of repairing of the buildings. |
| | | E | Adhesion of waterproofing materials on concrete (pull off test) |
| | 15.Week | L | The Second colloquium |
| | | E | |
| Format of | x lectures | | □ independent assignments |

<table>
<tr><td>instruction</td><td colspan="3">□ seminars and workshops<br>x exercises<br>□ on linein entirety<br>□ partial e-learning<br>□ field work</td><td colspan="3">x multimedia<br>□ laboratory<br>□ work with mentor<br>□ (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>0.7</td><td>Report</td><td>0.3</td><td>Preparation for experimental work</td><td>0.3</td></tr>
<tr><td>Essay</td><td></td><td>Seminar essay</td><td></td><td>Independent work</td><td>0.5</td></tr>
<tr><td>Tests</td><td>0.6</td><td>Oral exam</td><td>0.8</td><td>(Other)</td><td></td></tr>
<tr><td>Written exam</td><td>0.8</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">The exam can be finished over the two tests during the semester. Minimum for successful tests is the limit of the 50% resolved test. Each test in assessing participates with a share of the 40% of the final grade. Presence at lectures 70-100% participates with a share of the 5% of the final grade while the presence of the laboratory exercises from 100% participates with a share of the 15% of the final grade. The examination periods there is a written and oral exam. Minimum for successful written exam is the limit of the 50% resolved test. Passing one test (previous activity) is valuable in the summer semester examination period with a share of the 15% of the final grade. Written exam has a share of the 25% and verbal has a share of the 40% of the final grade. Students who have not passed any tests during the semester they take the examination through written and oral exams in the regular examination period. Minimum for successful tests the limit of the 50% resolved test. Written part of exam and oral part of exam participates with a share of the 50% of the final grade.<br>The final grade: 50%-61% - sufficient, 62%-74% - good, 75%-87% very good, 88%-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. Andrija Đureković; Cement, cementni kompozit i dodaci za beton, Školska knjiga, Zagreb 1996.</td><td>1</td><td></td></tr>
<tr><td colspan="3">2. H.F.W. Taylor; Cement chemistry, 2nd edition, Thomas Telford Publishing, Thomas Telford Services Ltd, London, 1997.</td><td>1</td><td></td></tr>
<tr><td colspan="3">3. Pierre-Claude Aïtcin, Sidney Mindess; Sustainability of Concrete, Spon Press, Oxon 2011.</td><td>1</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">Selected articles from journals recommended by lecturer</td></tr>
<tr><td>Quality assurance methods that ensure the</td><td colspan="6">1. Tracking suggestions and reactions of students throughout the semester<br>2. Student survey</td></tr>
</table>

| | |
|---|---|
| acquisition of exit competences | |
| Other (as the proposer wishes to add) | |

# Non-metallic Composites

| NAME OF THE COURSE | Non-metallic Composites | | | | | |
|---|---|---|---|---|---|---|
| **Code** | KTB210 | Year of study | 2nd | | | |
| Course teacher | PhD, Pero Dabić, 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 | - Awareness of the importance of non-metallic composite with programmed properties in contemporary society.<br>- Knowledge of the obtaining technology of such material.<br>- Independent preparation and evaluation of the properties of these materials. | | | | | |
| 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 passing the exam, the student will know about:<br>- The types of non-metallic composite materials<br>- Procedures for the preparation of non-metallic composite materials<br>- The composition, structure and properties of non-metallic composite materials<br>- The importance of non-metallic composites in modern society | | | | | |
| Course content broken down in detail by weekly class schedule (syllabus) | Week 1: Introductory lecture<br>Week 2: Composite non-metallic materials. Types and properties.<br>Week 3: Hydraulic mineral binders and composites.<br>Week 4: Mineral replacement supplements in obtaining of cement composites.<br>Week 5: Additives for cement composites with programmed properties.<br>Week 6: Concrete. Concrete based on cement binder.<br>Week 7: A fresh and hardened concrete.<br>Week 8: Assessment (first colloquium);<br>Week 9: Lightweight concretes.<br>Week 10: Ceramic and Bioceramic composites and materials.<br>Week 11: Selective inorganic membranes.<br>Week 12: Stacked metallic catalysts.<br>Week 13: Carbon composite materials. Other non-metallic composite materials.<br>Week 14: Final comments, discussion, conclusions. Assessment (second colloquium);<br>Laboratory exercises:<br>Exercise 1: Preparation of cement composites with replacement supplements.<br>Exercise 2 Determination of physico-chemical properties of cement composites.<br>Exercise 3 Determination of the heat of hydration of cement composites. | | | | | |

<table>
<tr><td></td><td colspan="6">Exercise 4 Composite materials based on red mud.<br>Exercise 5 Analysis of non-metallic composites by using EDXRF technique.</td></tr>
<tr><td>Format of instruction</td><td colspan="3">☒ lectures<br>☐ seminars and workshops<br>☐ exercises<br>☐ on line in entirety<br>☐ partial e-learning<br>☒ field work</td><td colspan="3">☐ independent assignments<br>☒ multimedia<br>☒ laboratory<br>☐ work with mentor<br>☐ (other)</td></tr>
<tr><td>Student responsibilities</td><td colspan="6">Attendance at lectures in the 80% amount, and laboratory exercises in 100% of the total number of lessons.</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>2.5</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>0.2</td><td>Preparation for the exam in the lab. exercises</td><td>0.3</td></tr>
<tr><td>Essay</td><td></td><td>Seminar essay</td><td></td><td>(Other)</td><td></td></tr>
<tr><td>Tests (written exam)</td><td>1.0</td><td>Oral exam</td><td></td><td>(Other)</td><td></td></tr>
<tr><td></td><td></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">Continuous evaluation:<br>The entire test can be laid across two exams during the semester. Pass rate threshold is 60%. Each colloquium in assessing participates with 35%. Laboratory exercises participate in the evaluation of 20%. The presence of lectures in 80-100% amount is 10% of the grade.<br>Final evaluation:<br>Students who have passed one colloquium, it is recognized as part of the exam (35% score). The remaining part is laid in the regular examination periods. Written examination in this case has a share of 70%, while laboratory exercises have a share of 20%.<br>Students who did not pass a single comprehensive exam midterm examination in the regular examination periods. Pass rate threshold is 60%. Laboratory work involved in assessing the share of 20%.<br>Rating: sufficient (60-70%), good (71-80%), very good (81-90%), excellent (91-100%).</td></tr>
<tr><td rowspan="9">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. K. Mazumdar, Composites Manufacturing, Material Product, and Process Engineering, CRC Press, New York, 2002.</td><td>1</td><td colspan="2"></td></tr>
<tr><td colspan="3">L. W. D. Callister, Materials Science and Engineering, John Wiley & Sons, Inc., New York, 1994.</td><td>1</td><td colspan="2"></td></tr>
<tr><td colspan="3">L. Hench, J. K. West, Chemical Processing of Advanced Materials, John Wiley & Sons, Inc., New York, 1992.</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</td><td colspan="6">S. N. Ghosh, Cement and Concrete Science Technology, Vol. 1., Part I, ABI Books</td></tr>
</table>

| | |
|---|---|
| (at the time of submission of study programme proposal) | Private Limited, New Delhi, 1991.; Application of Admixtures in Concrete, Ed. A. M. Paillere, E & FN SPON, London, 1995.; P. Bartos, Fresh Concrete, Properties and Test, Elsevier, Amsterdam, 1992.; A. Đureković, Cement, cementni kompozit i dodaci za beton, IGH i Školska knjiga, Zagreb, 1996. |
| Quality assurance methods that ensure the acquisition of exit competences | - Keeping records of class attendance<br>- Annual Performance analysis Examination<br>- Monitoring suggestions and reactions of participants during the semester<br>- Student survey |
| Other (as the proposer wishes to add) | |

# Structure and Properties of Inorganic Non-metallic Materials

| NAME OF THE COURSE | **Structure and Properties of Inorganic Non-metallic Materials** | | | | | | |
|---|---|---|---|---|---|---|---|
| Code | KTB211 | Year of study | 2nd | | | | |
| Course teacher | PhD, Jelica Zelić, prof. | Credits (ECTS) | 5.0 | | | | |
| Associate teachers | PhD, Mario Nikola Mužek, assistant | 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 | Qualifying students to adopt and apply basic knowledge of the structure and properties of inorganic non-metallic materials and methods of investigations as important preconditions to create materials of predetermining properties. | | | | | | |
| 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:<br>1. Explain the concept of minerals, crystals and amorphous state.<br>2. Explain the basic concepts and principles of crystallography.<br>3. Categorize the elements of symmetry of crystals and crystal systems.<br>4. Explain the interatomic bonds in crystals and the packing of atoms concept in the crystal structures.<br>5. Describe the basic concepts, parameters and principles in X-ray diffraction analysis, X-ray fluorescence spectroscopy, infrared spectroscopy, thermal analysis methods (DTA-TG/DTG) and electron microscopy (TEM, SEM).<br>6.Choosing the right approach in the selection of appropriate methods for structural characterization of materials starting from the knowledge acquired. | | | | | | |
| Course content broken down in detail by weekly class schedule (syllabus) | 1st week. Introduction. The Earth's crust, rocks, minerals, the environmental conditions and processes of minerals genesis.<br>2nd week: Overview of basic raw non-metallic materials.<br>3rd week: Crystalline and amorphous state. Basic crystallographic principles.<br>4th week: The crystal structure. Crystallographic axes, lattice parameters and lattice | | | | | | |

<table>
<tr><td></td><td colspan="6">planes in the crystal.<br>5th week: Symmetry elements. Crystal systems and symmetry. Unit cell parameters of crystals.<br>6th week: Bases of crystalochemistry. Coordination number. Pauling's rules for ionic crystals.<br>7th week: Theory of close-packed crystal structure. Main types of crystal structures. Silicate structures. Crystal lattice defects, isomorphism, polymorphism and solid solutions.<br>8th week: The physical, electrical, thermal and optical properties of crystalline substances. The written knowledge tests (I Colloquium).<br>9th week: The significance of the structural phases analyses in control and managing of manufacturing processes, and in holding out qualities of final industrial products. Examples from practice.<br>10th week: Methods for structural characterization of silicates, oxides and other inorganic engineering materials. Example for the identification of clay minerals by the combined methods of analysis (chemical analysis, X-ray analysis, thermal and infrared analysis).<br>11th week: The basic principles of the X-ray diffraction. X-ray spectra, continuous and characteristic spectrum. Bragg's equation. Qualitative and quantitative X-ray diffraction analysis. Silicate structures and their characteristic X-ray diffraction patterns.<br>12th week: Fluorescent X-ray analysis. Infrared spectroscopy. Characteristic absorption band position of the individual functional groups of minerals. Infrared spectra of the phylosilicates.<br>13th week: Methods for identification of microstructure. Electron microscopy and microanalysis.<br>14th week: Methods of thermal analysis. Differential thermal analysis (DTA), thermogravimetric analysis (TG/DTG) and differential scanning calorimetry (DSC). Applying the method of thermal analysis (DTA-TG/DTG) in chemistry of cement.<br>15th week: Electron microscopy and electron diffraction. Application of transmission (TEM) and scanning (SEM) electron microscopy and electron microanalysis on silicate materials. The written knowledge tests (II Colloquium).<br><br>EXERCISES:<br>1. Determination unit cell parameters and identification of the hkl indices of the powder sample.<br>2. Determination of crystallite size. Determination of the unit cell parameters by method oscillations of single crystals.<br>3. XRD characterization of crystal materials. Qualitative X-ray analysis of the mineral sample and the mixture of minerals.<br>4. Application of the method of thermal analysis (DTA-TG/DTG) in the chemistry of cement: (a) monitoring the progress of the hydration reaction in cement-water system (with and without pozzolana additions), and (b) the determination of kinetic parameters of thermal decomposition of portlandite formed in cement-water system.<br>5. Applying infrared spectroscopy: (a) in the analysis of the historic and cultural heritage monuments ("Mediterranean patinas" on the monuments of marble and limestone), and (b) in the analysis and identification of silicate.</td></tr>
<tr><td>Format of instruction</td><td colspan="3">x lectures<br>☐seminars and workshops<br>x exercises<br>☐on linein entirety<br>☐partial e-learning<br>☐ field work</td><td colspan="3">x independent assignments<br>☐ multimedia<br>x laboratory<br>☐work with mentor<br>☐ (other)</td></tr>
<tr><td>Student responsibilities</td><td colspan="6">Each student is required to do the entire exercises planned program (100%). On completion of all exercises the final written exam is obligated.</td></tr>
<tr><td>Screening student work(name the</td><td>Class attendance</td><td>1.0</td><td>Research</td><td></td><td>Practical training</td><td></td></tr>
</table>

| | | | | | | |
|---|---|---|---|---|---|---|
| *proportion of ECTS credits for each activity so that the total number of ECTS credits is equal to the ECTS value of the course)* | Experimental work | 0.5 | Report | 0,5 | (Other) | |
| | Essay | | Seminar essay | | (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 entire test can be applied over two (2) exams during the semester. Passing threshold is 60%. Each colloquium in assessing participates with 45%. 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 colloquium (previous activity) is true in the summer examination period with a share of 10% in the assessment. Written exam has a share of 40% and 50% verbal. Students who have not passed the exam by tests take the examination through written and oral exams in the regular examination period. Passing threshold is 60% and the examination form to participate in the evaluation by 50%.<br>Rating: 60% -70% - satisfactory, 71% -81% - good, 82% -92% very good, 93% - 100% - excellent. |

| | **Title** | **Number of copies in the library** | **Availability via other media** |
|---|---|---|---|
| Required literature (available in the library and via other media) | T. Terić, J. Zelić, Structural phase analysis/ Strukturna analiza faza, Faculty of Chemistry and Technology in Split, Split, 2008. (printed course materials). | 6 | |
| | J. Zelić, Practicum in the processes of inorganic industry /Praktikum iz procesa anorganske industrije (in Croatian), Faculty of Chemistry and Technology in Split, Split, 2013 (reviewed and edited teaching materials),<br>http:// www.ktf-split.hr/bib/nm/Procesi _anorganske_ industrije.pdf | 1 | www.ktf-split.hr |

| | |
|---|---|
| Optional literature (at the time of submission of study programme proposal) | 1. A. R. West, Solid State Chemistry and its Application, Wiley & Sons Ltd., 1992, ISBN 0 471 90377 9 (U.S.).<br>2. P. Petrovski, Uvod u rentgensku difraktometriju i mineralna rentgenska analiza cementa, Univerzitetski udžbenik, Univerzitet u Zenici, B&H, Zenica, 2006. ISBN 9958-716-16-X. |
| Quality assurance methods that ensure the acquisition of exit competences | Quality of the teaching and learning monitored at the level of the<br>(1) teachers, accepting suggestions of students and colleagues, and<br>(2) Faculty, conducting surveys of students on teaching quality. |
| Other (as the proposer wishes to add) | |

# Corrosion and Degradation of Building Materials

| NAME OF THE COURSE | Corrosion and Degradation of Building Materials | | | | | |
|---|---|---|---|---|---|---|
| Code | KTB212 | Year of study | 2nd | | | |
| Course teacher | PhD, Jelica Zelić, prof. | Credits (ECTS) | 5.0 | | | |
| Associate teachers | PhD, Mario Nikola Mužek, assistant | Type of instruction (number of hours) | L | S | E | F |
| | | | 30 | | 20 | 10 |
| Status of the course | Elective | Percentage of application of e-learning | - | | | |

| COURSE DESCRIPTION | |
|---|---|
| Course objectives | Qualifying students to apply the knowledge about the processes of deterioration and corrosion in the resistance and durability assessment of technically important inorganic non-metallic building materials under natural conditions of their application, with special emphasis on techno-economic and environmental aspects. |
| Course enrolment requirements and entry competences required for the course | Inorganic processes in heterogeneous systems |
| Learning outcomes expected at the level of the course (4 to 10 learning outcomes) | After passing the exam, students will be able to:<br>1. Distinguish the mechanism of corrosion and non-metals.<br>2. Categorize types of chemical corrosion of concrete, mortar and cement composites as a result of the interaction of concrete (mortar, cement composite) and aggressive environment.<br>3. Explain the model of the chemical action of sea water on concrete or reinforced concrete.<br>4. Assess the impact of atmospheric corrosion and deterioration of technical and decorative stone including historic and cultural heritage monuments.<br>5. Anticipate the consequences of alkali-aggregate reaction.<br>6. Assess the impact of pozzolanic additives and other additives (finely ground limestone) on the prevention of corrosion and improve the durability of concrete, mortar and cement composites.<br>7. Explain the process of deterioration/corrosion of technical glass surface by weathering.<br>8. Apply methods to examine the impact of an aggressive environment on the durability of construction structures.<br>9. Evaluate and propose protection measures in order to improve the durability of selected building materials. |
| Course content broken down in detail by weekly class schedule (syllabus) | 1st week: Economic and ecological significance of environmental effects on construction. Basic theory of the corrosion processes with special emphasis on the effects of the environment on building materials. Destructive phenomena in corrosion of metals and non-metals.<br>2nd week: Technical important non-metallic inorganic building materials. Relationship between structure and properties of materials in assessing their resistance and durability under natural conditions of their use.<br>3rd week: The factors affecting the degradation of structures of concrete, mortar and cement composites. Types and mechanisms of chemical corrosion depending on the aggressive environment. |

<table>
<tr><td></td><td colspan="6">4nd week: Chemical corrosion in soil, seawater and process industry. Selected examples of chemical corrosion of concrete and reinforced concrete structures. Sulphate corrosion, products and consequences of concrete corrosion.<br>5th week: Influence of types of cement, sulphate concentrations, types of cations bonded to the sulfate ion, temperature and exposure time on the rate of corrosion of concrete. Pozzolanic materials.<br>6th week: Types of concrete. Concrete with recycled materials. Concrete and sustainability. Life cycle analysis.<br>7th week: Self-cleaning concrete. Translucent concrete. Geopolymers. New composite materials with high corrosion resistance and durability.<br>8th week: Rocks. Definition. Division. The structure of the stone and the application. The written knowledge tests (I Colloquium).<br>9th week: The factors affecting the degradation of the structure of technical and decorative stone. Types and mechanisms of chemical corrosion depending on the aggressive environment. Alkali-silica reaction. Causes and consequences.<br>10th week: Chemistry of the formation of "black crust" on the rock carbonate origin (limestone, marble) and deterioration of rock by weathering ($H_2O$, $SO_2$, $CO_2$, soot). Mediterranean patinas on historical and cultural heritage monuments. Hypothesis of their origin.<br>11th week: Test methods. Protection measures in practice.<br>Week 12: Glass. Definition. Composition of technical glass. Holders of the structure and types of technical glass.<br>13th week: The kinetics and mechanism of deterioration/corrosion of the glass surface by weathering. Hydration and hydrolysis of the Na-silicate glass.<br>14th week: Hydrolytic resistance of glass. Test methods. Protection measures.<br>15th week: The written knowledge tests (II Colloquium).<br><br>EXERCISES:<br>1. Determination of corrosion resistance of the Portland cement mortars (with and without pozzolanic additions) to sulphate attack of $Na_2SO_4$ and $MgSO_4$ solutions by measurements the mechanical strength (compressive and flexural), modulus of elasticity, changes of volume due to swelling, and by quantification of unleached calcium hydroxide.<br>2. Determination of calcium hydroxide in hydrated Portland cement mortars (with and without pozzolanic additions) by thermal analysis (DTA -TG/DTG).<br>3. Testing effect of acid on different types of rocks. Testing of alkali-aggregate reaction.<br>4. Characterization of the Mediterranean patinas on the rock carbonate origin, including historic and cultural heritage monuments, by FTIR method.<br>5. Determination of hydraulic resistance of technical glass.<br>6. Visual observation of objects on the ground, and field trials.</td></tr>
<tr><td>Format of instruction</td><td colspan="3">**x** lectures<br>☐seminars and workshops<br>**x** exercises<br>☐*on line*in entirety<br>☐partial e-learning<br>**x** field work</td><td colspan="3">**x** independent assignments<br>**x** multimedia<br>**x** laboratory<br>☐work with mentor<br>☐ (other)</td></tr>
<tr><td>Student responsibilities</td><td colspan="6">Implementation and analysis of selected processes according to preset conditions. Each student is required to do the entire exercises planned program and field work (100%). On completion of all exercises the final written exam is obligated.</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>1.0</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>0.5</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>
</table>

| | | | | | | |
|---|---|---|---|---|---|---|
| *ECTS credits is equal to the ECTS value of the course)* | Tests | 0.5 | Oral exam | 1.0 | (Other) | |
| | Written exam | 1.0 | Project | | (Other) | |
| Grading and evaluating student work in class and at the final exam | The entire test can be applied over two (2) exams during the semester. Passing threshold is 60%. Each colloquium in assessing participates with 45%. 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 colloquium (previous activity) is true in the summer examination period with a share of 10% in the assessment. Written exam has a share of 40% and 50% verbal. Students who have not passed the exam by tests take the examination through written and oral exams in the regular examination period. Passing threshold is 60% and the examination form to participate in the evaluation by 50%.<br>Rating: 60% -70% - satisfactory, 71% -81% - good, 82% -92% very good, 93% - 100% - excellent. | | | | | |

| | **Title** | **Number of copies in the library** | **Availability via other media** |
|---|---|---|---|
| Required literature (available in the library and via other media) | J. Zelić, Z. Osmanović, Čvrstoća i trajnost cementnih kompozita / Strength and Durability of the Cement Composites, (in Croatian), Manualia Universitatis Studiorum Spalatensis, University of Split, Split, 2014, ISBN 978-953-7803-01-8. | 1 | www.ktf-split.hr |
| | J. Zelić, Praktikum iz procesa anorganske industrije/ Practicum in the processes of inorganic industry, (in Croatian), Faculty of Chemistry and Technology in Split, Split, 2013 (reviewed and edited teaching materials),<br>http:// www.ktf-split.hr/bib/nm/Procesi _anorganske_ industrije.pdf | 1 | www.ktf-split.hr |
| | Z. Osmanović, J. Zelić, Proizvodnja Portland-cementa / Production of Portland Cement, Manualia Universitatis Studiorum Tuzlaensis, University of Tuzla, B&H, Tuzla, 2010.,<br>ISBN 978-9958-897-04-7.<br>http://www.knjiga.ba/proizvodnja_portlandj_cementa-k7412.html | 5 | www.knjiga.ba |
| Optional literature (at the time of submission of study programme proposal) | 1. J. Zelić, Engineering of Selected Inorganic Materials/Inženjerstvo odabranih anorganskih materijala (in English), Manualia Universitatis Studiorum Spalatensis, University of Split, Split, 2014, peer review.<br>2. J. Zelić, Engineering of Selected Inorganic Materials/Inženjerstvo odabranih anorganskih materijala (in English), Faculty of Chemistry and Technology in Split, Split, 2013. (reviewed and edited teaching materials),<br>http:// www.ktf-split.hr/bib/nm/Inzenjerstvo _odabranih_ anorganskih_ materijala_en.pdf<br>3. R. A. McCauley, Corrosion of Ceramic and Composite Materials, 2nd Ed., CRC Press, 2004, ISBN 0-8247-5366-6.<br>4. C. Saiz-Jimenez (Ed.), Air pollution and Cultural Heritage, Taylor & Francis Group, London, 2004, ISBN 90 5809 682 3. | | |
| Quality assurance methods that ensure the acquisition of exit competences | Quality of the teaching and learning monitored at the level of the<br>(1) teachers, accepting suggestions of students and colleagues, and<br>(2) Faculty, conducting surveys of students on teaching quality. | | |
| Other (as the | | | |

| | |
|---|---|
| proposer wishes to add) | |

# Corrosion and Materials Protection

| NAME OF THE COURSE | Corrosion and Materials Protection | | | | | |
|---|---|---|---|---|---|---|
| Code | KTB213 | 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 the 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:<br>- define and classify the corrosion processes<br>- evaluate the resistance of materials for any given conditions<br>- perform the corrosion tests<br>- 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.<br>2nd week: Chemical corrosion. thermodynamic conditions. The mechanism and kinetics of chemical corrosion process. Resistance to chemical corrosion.<br>3rd week: Electrochemical corrosion. Thermodynamic conditions. The mechanism and kinetics of electrochemical corrosion process. Types of electrochemical corrosion.<br>4th week: Corrosion of inorganic materials (corrosion of concrete, reinforcement in concrete, ceramics and glass in aggressive environments).<br>5th week: Corrosion under specific conditions: in the atmosphere, water, sea water.<br>6th week: Corrosion in soil, in melts.<br>7th week: Corrosion caused by microorganisms.<br>8th week: First test<br>9th week: Corrosion protection by materials selection and proper designing.<br>10th week: Materials protection using corrosion inhibitors.<br>11th week: Electrochemical methods of protection.<br>12th week: Surface protection. Selection of coatings and paints.<br>13th week: The importance of inspection and maintenance.<br>14th week: Corrosion tests. Standards.<br>15th week:. Second test.<br>Exercises: | | | | | |

| | |
|---|---|
| | Monitor atmospheric corrosion. Examination of corrosion rate by polarization methods. Determination of the critical pitting temperature of stainless steel. 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. |
| Format of instruction | x lectures<br>□ seminars and workshops<br>x exercises<br>□ *on line*in entirety<br>□ partial e-learning<br>□ field work<br>□ independent assignments<br>X multimedia<br>□ laboratory<br>□ work with mentor<br>☐(other) |
| Student responsibilities | Lecture attendance: 80 %. Exercises attendance: 100 %. |

| 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 | 1 |
| | Experimental work | | Report | | (Other) | |
| | Essay | | Seminar essay | | (Other) | |
| | Tests | 2.5 | Oral exam | | (Other) | |
| | Written exam | | Project | | (Other) | |

| | |
|---|---|
| Grading and evaluating student work in class and at the final exam | 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). |

| Required literature (available in the library and via other media) | **Title** | **Number of copies in the library** | **Availability via other media** |
|---|---|---|---|
| | J.R. Davis, Corrosion – understanding the basic, ASM International, 2000. | 1 | |
| | B. Jarić, A. Rešetić, Korozija i katodna zaštita, Korexpres, Zagreb, 2003. | 1 | |
| | I. Esih, Osnove površinske zaštite, Fakultet strojarstva i brodogradnje Sveučilišta u Zagrebu, Zagreb, 2003. | 1 | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |

| | |
|---|---|
| Optional literature (at the time of submission of study programme proposal) | R. Babolan, Corrosion Tests and Standards, Amer. Tech. Pulbl. Ltd. New York, 1995.<br>P. Marcus, J. Oudar (Eds.), Corrosion Mechanisms in Theory and Practice, M. Dekker, New York, 1995. |
| Quality assurance methods that ensure the acquisition of exit | - Tracking suggestions and reactions of participants during the semester<br>- Student survey |

| | |
|---|---|
| competences | |
| Other (as the proposer wishes to add) | |

# Electrodeposition Processes

| NAME OF THE COURSE | Electrodeposition Processes | | | | | |
|---|---|---|---|---|---|---|
| Code | KTB21 | Year of study | 2nd | | | |
| Course teacher | PhD, Ladislav Vrsalović, associate 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 | Students will acquire knowledge that enables them to perform self-monitoring or performing electroplating process. The knowledge acquired can also use to explore and improve the electrodeposition processes. | | | | | |
| 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 successfully passing the exam, students will be able to:<br>1. Select the most appropriate metal coating for the corresponding metal surfaces.<br>2. Independently run or monitor the electroplating process.<br>3. Distinguish all process parameters that affect the quality of metal coatings.<br>4. Examine the quality of the obtained metallic coatings. | | | | | |
| Course content broken down in detail by weekly class schedule (syllabus) | Week 1: Introduction. Technological processes of production galvanic and chemical coating.<br>Week 2: Metal deposition on cathode. Electrocrystallization. Current distribution and metal sediment on cathode. Sedimentary power of the electrolyte.<br>Week 3: Preparation of specimen for metallic coatings deposition.<br>Week 4: Metallic coatings. The criteria for selection of metal coatings. Criteria for the selection of conversion coatings.<br>Week 5: Galvanization. Composition of bath. Material and shape of anodes for electroplating. Influence of electrolyte temperature, convection and current density.<br>Week 6: Sources of current and facilities for electroplating. The most important processes of metal electroplating. Tin-plating in different electrolytes.<br>Week 7: Zinc-plating.<br>Week 8: Copper plating.<br>Week 9: Nickel-plating. Cathodic and anodic processes in deposition of nickel. Basic electrolyte components. Influence of additives on plating shining nickel. Nickel anodes.<br>Week 10: Chromium plating. Deposition of metallic chromium on cathode. Basic electrolyte components for chromium plating. Anodes and anode processes. Coating errors. I. partial knowledge test.<br>Week 11: Plating with noble metals.<br>Week 12: Manufacturing of metallic coatings by spraying with melting metal. Coatings which was produced by diffusion processes.<br>Week 13: Electroplating of non-metal substrates. Electroplating of product of porous | | | | | |

<table>
<tr><td></td><td colspan="6">materials.<br>Week 14: Electroforming. Mechanical preparation of model for galvanization. Galvanization in electroforming. Reinforcing of galvanic layers. Separation of final product from model. Final treatment of product.<br>Week 15: Production of foils, sheets and pipes by electroforming. II. Partial knowledge test.<br><br>List of laboratory exercises:<br>Preparing of metal surface for metal layer formation (mechanical, chemical, electrochemical) and their comparison; nickel electroplating, copper electroplating, Electroless formation of a nickel coating, anodic oxidation of aluminum, phosphating.</td></tr>
<tr><td>Format of instruction</td><td colspan="3">×lectures<br>□seminars and workshops<br>×exercises<br>□on linein entirety<br>□partial e-learning<br>□field work</td><td colspan="3">□independent assignments<br>×multimedia<br>×laboratory<br>□work with mentor<br>□ (other)</td></tr>
<tr><td>Student responsibilities</td><td colspan="6">Lectures, 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>0.5</td><td>Research</td><td></td><td>Practical training</td><td></td></tr>
<tr><td>Experimental work</td><td>0.5</td><td>Report</td><td>0.5</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</td><td>Oral exam</td><td>1.5</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">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.<br>Scoring: <55% insufficient;55-66% sufficient (2); 67-78% good (3); 79-90% very good (4); 91-100% excellent (5)</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. Gojić, površinska obradba materijala, Metalurški fakultet Sveučilišta u Zagrebu, Sisak, 2010.</td><td>2</td><td></td></tr>
<tr><td colspan="3">E. Stupnišek Lisac, Korozija i zaštita konstrukcijskih materijala, FKIT Zagreb, 2007.</td><td>1</td><td></td></tr>
<tr><td colspan="3">M. Schlesinger, M. Paunović, Modern electroplating, IV edition, J. Wiley & Sons, USA, 2000.</td><td>1</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">I. Esih, Z. Dugi, Tehnologija zaštite od korozije, Školska knjiga, Zagreb,1990.<br>I. Esih, Osnove površinske zaštite, Sveučilište u Zagrebu, Zagreb, 2003.<br>D.A. Jones, Principles and Prevention of Corrosion, 2nd Ed. Prentice Hall, Upper Sadle River, 1996.<br>M. Paunović, M. Schlesinger, Fundamentals of electrochemical deposition, J. Wiley & sons, USA 1998.</td></tr>
<tr><td>Quality assurance methods that ensure the acquisition of exit competences</td><td colspan="6">Keeping records of student attendance; annual analysis of the exam results; student survey in order to evaluate teachers, self–evaluation of teachers, feedback from students who have already graduated to relevance of curriculum.</td></tr>
</table>

| | |
|---|---|
| Other (as the proposer wishes to add) | |

# Surface Protection Technology

| NAME OF THE COURSE | Surface Protection Technology | | | | | |
|---|---|---|---|---|---|---|
| Code | KTB215 | Year of study | 2nd | | | |
| Course teacher | PhD, Ladislav Vrsalović, associate prof. | Credits (ECTS) | 5.0 | | | |
| Associate teachers | | Type of instruction (number of hours) | L | S | E | F |
| | | | 30 | | 25 | 5 |
| Status of the course | Elective | Percentage of application of e-learning | | | | |
| **COURSE DESCRIPTION** | | | | | | |
| Course objectives | Students will learn about different methods of surface protection. Students will be able to choose efficient corrosion protection system and pursue its maintenance. They will be informed in application of norms that are concern in materials surface protection. | | | | | |
| 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:<br>• Define methods of materials surface protection.<br>• Distinguish the most important features of individual processes of materials surface protection.<br>• Select the appropriate procedure for the protection of materials.<br>• Evaluate the efficiency of implementing procedures for the protection of materials and structures. | | | | | |
| Course content broken down in detail by weekly class schedule (syllabus) | Week 1: Introduction. Economic aspects of surface protection.<br>Week 2: The choice of the protection system. Temporary and permanent protection.<br>Week 3: Surface preparation and standards.<br>Week 4: Metallic coatings. The criteria for metal coatings selection. The criteria for the conversion coatings selection.<br>Week 5: Protective coatings and organic coatings. Effectiveness in service.<br>Week 6: Classification by type, composition and purpose. Coating systems.<br>Week 7: Design and execution of corrosion protection coatings.<br>Week 8: Coatings for temporary protection. Antifouling coatings.<br>Week 9: Methods for applying coatings, and coatings.<br>Week 10: I. partial knowledge test. Inhibitors in coatings.<br>Week 11: Mixtures of inhibitors. Use of inhibitors in maritime transport.<br>Week 12: Protective isolation and elimination of the associated problems due to corrosion.<br>Week 13: Maintenance of corrosion protection systems. Methods of analysis of protective coatings and linings.<br>Week 14: Rubber coatings. Bitumenisation.<br>Week 15: Enameling. II. Partial knowledge test. | | | | | |

<table>
<tr><td></td><td colspan="6">Laboratory exercises<br>Preparation of metal surfaces and application of organic coating. Determination of wet film thickness of the organic coating. Determination of physical and mechanical properties of organic coatings. The application of polarization techniques to determine the protective properties of the coating. Application of electrochemical impedance spectroscopy in the study of organic coatings. Nickel plating in steel protection. Visits to the laboratory for corrosion protection of company Shipbuilding Industry Split. A visit to the company Adriacink.</td></tr>
<tr><td>Format of instruction</td><td colspan="3">×lectures<br>□seminars and workshops<br>×exercises<br>□on linein entirety<br>□partial e-learning<br>□field work</td><td colspan="3">□independent assignments<br>×multimedia<br>×laboratory<br>□work with mentor<br>□ (other)</td></tr>
<tr><td>Student responsibilities</td><td colspan="6">Lectures, 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>0.5</td><td>Research</td><td></td><td>Practical training</td><td></td></tr>
<tr><td>Experimental work</td><td>0.5</td><td>Report</td><td>0.5</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</td><td>Oral exam</td><td>1.5</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">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.<br>Scoring: <55% insufficient;55-66% sufficient (2); 67-78% good (3); 79-90% very good (4); 91-100% excellent (5)</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 colspan="2">Availability via other media</td></tr>
<tr><td colspan="3">E. Stupnišek-Lisac, Korozija i zaštita konstrukcijskih materijala, FKIT Zagreb, Zagreb 2007.</td><td>1</td><td colspan="2"></td></tr>
<tr><td colspan="3">Y. I. Kuznetsov, Organic inhibitors of corrosion of metals, Plenum Press, New York, 1996.</td><td>1</td><td colspan="2"></td></tr>
<tr><td colspan="3">M. Gojić, Površinska obradba materijala, Metalurški fakultet Sveučilišta u Zagrebu, Sisak 2010.</td><td>2</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">P. R. Roberge, Handbook of corrosion engineering, McGrow-Hill, New York, 2000.<br>H. H. Uhligh, R.W. Revie, Corrosion and corrosion control, John Wiley and Sons, New York 1985.</td></tr>
<tr><td>Quality assurance methods that ensure the acquisition of exit competences</td><td colspan="6">Keeping records of student attendance; annual analysis of the exam results; student survey in order to evaluate teachers, self-evaluation of teachers; feedback from students who have alredy graduated to relevance of curriculum.</td></tr>
<tr><td>Other (as the proposer wishes to add)</td><td colspan="6"></td></tr>
</table>

# Electrochemical Methods and Their Application

| NAME OF THE COURSE | Electrochemical Methods and Their Application | | | | | |
|---|---|---|---|---|---|---|
| Code | KTB216 | Year of study | 2nd | | | |
| Course teacher | PhD, Senka Gudić, 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 | Student will acquire proficiency in knowledge that allowed him to perform electrochemistry experiment and complete the research of mechanism and kinetics of electrode processes. | | | | | |
| 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 successfully passed exam student is able to:<br>- explain the mechanism and kinetics of electrode processes<br>- properly choose the experimental method of measurement<br>- carry out electrochemical experiment independently<br>- analyze the experimental results<br>- predict the behavior of metallic materials under different conditions. | | | | | |
| Course content broken down in detail by weekly class schedule (syllabus) | 1st week: Introduction. Metal/electrolyte phase boundary.<br>2nd week: Electrochemical experiment. Electrochemical cell and electrodes. Electrode materials. Calibration of electrodes and cell.<br>3rd week: Electricity passage through electrochemical cell. Instruments (potentiostat/galvanostat).<br>4th week: Hydrodynamic electrodes. Limiting current at hydrodynamic electrodes. Rotating disc electrode and rotating ring-disc electrode.<br>5th week: Linear potential sweep methods. Polarization resistance method measurement. Tafel method.<br>6th week: Potentiodynamic polarization measurements in a wide potential range. Application of linear polarization methods - examples from practice.<br>7th week: Cyclic voltammetry. Cyclic voltammetry on planar and spherical electrode.<br>8th week: Cyclic voltammetry of coupled component systems. Application of cyclic voltammetry - examples from practice.<br>9th week: First test. Pulse methods. Chronoamperometry. Chronocoulometry. Chronopotentiometry.<br>10th week: Pulse voltammetry. Pulse polarography. Other pulse methods. Application of pulse methods - examples from practice.<br>11th week: Electrochemical impedance spectroscopy. Basic of alternating current. Detection and measuring of impedance.<br>12th week: Impedance and equivalent circuit of electrochemical cell. Faradaic impedance of simple electrode processes.<br>13th week: Presentation of results in complex impedance planes. Complexes systems and constant phase element. | | | | | |

<table>
<tr><td></td><td colspan="6">14th week: Admittance. A.c. voltammetry. A.c. polarography. Application of impedance methods - examples from practice.<br>15th week: Second test.<br>Exercises:<br>Polarization of copper in NaCl solution. Investigation of electrochemical behavior of iron using cyclic voltammetry. Chronoamperometric and chronopotentiometric growth of oxide films on aluminum. Characterization of oxide films on aluminum using electrochemical impedance spectroscopy. Study of corrosion behavior of iron using Impedance spectroscopy. Negative differential effect of magnesium.</td></tr>
<tr><td>Format of instruction</td><td colspan="3">× lectures<br>☐ seminars and workshops<br>× exercises<br>☐ on linein entirety<br>☐ partial e-learning<br>☐ field work</td><td colspan="3">☐ independent assignments<br>× multimedia<br>× laboratory<br>☐ work with mentor<br>☐(other)</td></tr>
<tr><td>Student responsibilities</td><td colspan="6">Lecture attendance: 80 %. Laboratory 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>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></td><td>(Other)</td><td></td></tr>
<tr><td>Tests</td><td>1</td><td>Oral exam</td><td>1.5</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 complete exam can be passed through two tests during semester. The passing score is 60 % and the fraction of each test is 40 %. The fraction of laboratory exercises is 20%. In the exam period the student has to attend to written and oral exam. Grades: < 60% insufficient, 60-70% sufficient, 71-80% good, 81-92% very good, 93-100% 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">C.M.A. Brett and A.M. Oliveira-Brett, Electrochemistry: Principles, Methods and Applications, Oxford University Press, Inc., New York, 1993.</td><td>1</td><td colspan="2"></td></tr>
<tr><td colspan="3">A.J. Bard and L.R. Faulkner, Electrochemical Methods: Fundamentals and Applications, 2nd Edition, J. Wiley & Sons, Inc., New York, 2001.</td><td>1</td><td colspan="2"></td></tr>
<tr><td>Optional literature</td><td colspan="6">H.D. Abruna (Ed.), Electrochemical Interfaces: Modern Techniques for in-situ Interface Characterization, VCH Publishers, Inc., Cambridge, 1991.</td></tr>
<tr><td>Quality assurance methods that ensure the acquisition of exit competences</td><td colspan="6">- monitoring of students suggestions and reactions during semester<br>- students evaluation organized by University</td></tr>
<tr><td>Other (as the proposer wishes to add)</td><td colspan="6"></td></tr>
</table>

# Corrosion Inhibitors

| NAME OF THE COURSE | Corrosion Inhibitors | | | | | |
|---|---|---|---|---|---|---|
| Code | KTB217 | Year of study | 2nd | | | |
| Course teacher | PhD, Senka Gudić, 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 | Gaining knowledge necessary for the proper selection of corrosion inhibitors, depending on materials, environment, and other conditions of use and to evaluate its effectiveness. | | | | | |
| 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 successfully passed exam student is able to:<br>- define corrosion inhibitors<br>- identify factors that affect the inhibitory properties of particular compounds<br>- properly select corrosion inhibitor, depending on materials conditions of use<br>- explain the corrosion inhibition mechanism<br>- determine the corrosion inhibition effectiveness<br>- evaluate the ecological impact of corrosion inhibitors. | | | | | |
| Course content broken down in detail by weekly class schedule (syllabus) | 1st week: Introduction. Historical overview of corrosion inhibition. Electrochemical double layer and zero charge potential.<br>2nd week: Effect of inhibitors on kinetics of electrochemical reactions. Adsorption processes. Effect of the chemical structure of organic compounds on their protective properties.<br>3rd week: Role of the medium composition in metals protection from corrosion. Effect of pH.<br>4th week: Inhibition in acid solutions. Problems in selecting inhibitors for acid media.<br>5th week: Inhibition in neutral solutions. Inorganic inhibitors. Organic inhibitors. Chelating agents as corrosion inhibitors in neutral solutions.<br>6th week: Inhibition of localized corrosion.<br>7th week: First test. Mechanism of corrosion inhibition.<br>8th week: Hard and soft acids and bases interaction (HSAB principle). HSAB concept in corrosion inhibition. Application of HSAB principle to specific adsorption at electrode.<br>9th week: Hammett equation. Application of Hammett equation in corrosion inhibition.<br>10th week: The Hansch model. Hansch model in corrosion inhibition. Free and Wilson correaltions.<br>11th week: Inhibitors for atmospheric corrosion. Inhibitors for temporary protection. Vapor phase corrosion inhibitors.<br>12th week: Determination of inhibitor efficiency using electrochemical and non-electrochemical techniques.<br>13th week: Real problems in inhibition of corrosion. Possibilities for improving | | | | | |

<table>
<tr><td></td><td colspan="6">inhibitors effectiveness.<br>14th week: Environmental friendly inhibitors. Inhibitors toxicity. Possibility of replacement of toxic inhibitors with new environmental friendly.<br>15th week: Second test.<br><br>Exercises:<br>Inhibition of pitting corrosion of Al by $NaNO_2$. Determination of thermodynamic properties in the adsorption of p-hydroxybenzoic acid on Cu. Influence of thiourea on iron corrosion in acidic solution. Influence of thermal and mechanical treatment of the materials on its corrosion resistance. Corrosion inhibition of steel by caffeine. Study of zinc corrosion inhibition using the Mylins method.</td></tr>
<tr><td>Format of instruction</td><td colspan="3">× lectures<br>□ seminars and workshops<br>× exercises<br>□ on linein entirety<br>□ partial e-learning<br>□ field work</td><td colspan="3">□ independent assignments<br>× multimedia<br>× laboratory<br>□ work with mentor<br>☐(other)</td></tr>
<tr><td>Student responsibilities</td><td colspan="6">Lecture attendance: 80 %. Laboratory 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>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></td><td>(Other)</td><td></td></tr>
<tr><td>Tests</td><td>1</td><td>Oral exam</td><td>1.5</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 complete exam can be passed through two tests during semester. The passing score is 60 % and the fraction of each test is 40 %. The fraction of laboratory exercises is 20%. In the exam period the student has to attend to written and oral exam. Grades: < 60% insufficient, 60-70% sufficient, 71-80% good, 81-92% very good, 93-100% excellent.</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. Gudić, Inhibitori korozije metala, KTF-Split, 2006.</td><td></td><td colspan="2">web</td></tr>
<tr><td colspan="3">V.S. Sastri, Corrosion Inhibitors, J. Wiley & Sons, Inc., New York, 1998.</td><td>1</td><td colspan="2"></td></tr>
<tr><td colspan="3">Y.I. Kuznetsov, Organic Inhibitors of Corrosion of Metals, Plenum Press, New York, 1996.</td><td>1</td><td colspan="2"></td></tr>
<tr><td>Optional literature</td><td colspan="6">E. Kalman, Routes to the Developmens of Low Toxicity Corrosion Inhibitors in Corrosion Inhibitors, The Institute of Materials, London, 1994.<br>R. W. Revie (Ed.), Uhlig′s Corrosion Handbook, J. Wiley & Sons, Inc., New York, 2000.</td></tr>
<tr><td>Quality assurance methods that ensure the acquisition of exit competences</td><td colspan="6">- monitoring of students suggestions and reactions during semester<br>- students evaluation organized by University</td></tr>
<tr><td>Other (as the proposer wishes to</td><td colspan="6"></td></tr>
</table>

| | |
|---|---|
| add) | |

# Solid Waste Recycling

| NAME OF THE COURSE | SOLID WASTE RECYCLING | | | | | |
|---|---|---|---|---|---|---|
| Code | KTB221 | Year of study | 2. | | | |
| Course teacher | Ph.D. Ivana Smoljko, assistant professor | Credits (ECTS) | 5.0 | | | |
| Associate teachers | | Type of instruction (number of hours) | P | S | V | T |
| | | | 30 | 0 | 25 | 5 |
| Status of the course | Elective | Percentage of application of e-learning | | | | |

| COURSE DESCRIPTION | |
|---|---|
| Course objectives | The course will provide multidisciplinary knowledge regarding all aspects of municipal and industrial solid waste recycling technology, such as project management, energy efficiency and economy, quality assurance, environmental protection, safety and health, and legal aspects and their effect on technological choices. |
| 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:<br>- identify key sources, typical quantities generated, composition, and properties of solid waste;<br>- describe and explain recovery and recycling techniques and their impacts;<br>- identify and quantitatively assess recycling technologies according to the characteristics of the materials to be recovered;<br>- analyse quantitative and qualitative problems associated with operation of recycling techniques;<br>- estimate solid waste recycling costs. |
| Course content broken down in detail by weekly class schedule (syllabus) | 1st week: Introduction. Definition of solid waste (physical, chemical and biological characteristics of solid wastes). Technological, economic, environmental and social aspects of recycling.<br>2nd week: Recyclability criteria. Ecodesign.<br>3rd week: Characterisation of waste streams, recycling and solid waste characterisation.<br>4th week: Recycling of complex multimaterial consumer goods (cars, electronics, etc.).<br>5th week: Recycling Technologies: paper.<br>6th week: Recycling Technologies: glass.<br>7th week: First test.<br>8th week: Recycling Technologies: ferrous metals.<br>9th week: Recycling Technologies: non-ferrous metals.<br>10th week: Recycling Technologies: composite materials.<br>11th week: Recycling Technologies: bio-waste.<br>12th week: Recycling Technologies: textiles and carpets.<br>13th week: The economics of recycling. |

<table>
<tr><td></td><td colspan="6">14th week: Trends in solid waste recycling: issues, challenges and opportunities.<br>15th week: Second test.<br><br>Exercises: Reuse/recycle citrus peels. Ethanol production by distillation of fermented grape pomace. Calcium tartrate production. Fieldwork at the Karepovac landfill. Fieldwork at the Cijan d.o.o. company.</td></tr>
<tr><td>Format of instruction</td><td colspan="3">☒ lectures<br>☐seminars and workshops<br>☒ exercises<br>☐ on line in entirety<br>☐ partial e-learning<br>☒field work</td><td colspan="3">☒ independent assignments<br>☒ multimedia<br>☒ laboratory<br>☐ work with mentor<br>☐ (other)</td></tr>
<tr><td>Student responsibilities</td><td colspan="6">Lecture attendance: 80 %. Laboratory exercises attendance: 100 %.</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>0</td><td>Practical training</td><td>0</td></tr>
<tr><td>Experimental work</td><td>0.5</td><td>Report</td><td>0.5</td><td>(Other)</td><td></td></tr>
<tr><td>Essay</td><td>0</td><td>Seminar essay</td><td></td><td>(Other)</td><td></td></tr>
<tr><td>Tests</td><td>1</td><td>Oral exam</td><td>1.5</td><td>(Other)</td><td></td></tr>
<tr><td>Written exam</td><td>1</td><td>Project</td><td>0</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. Examination passing rate is 55%. Students who do not pass the partial exams have to take an exam in the regular examination periods. The exam consists of two parts: written and oral. Written part will constitute 40% and oral part will constitute 60% of the final score.<br>Grades with numerical equivalents: <55% insufficient – fail (1); 55%-65% - sufficient (2); 66% -77% - good (3); 78% -89% 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">E. Worrell, M. A. Reuter, Handbook of Recycling: State-of-the-art for Practitioners, Analysts, and Scientists, Elsevier Inc., United Stated of America, 2014.</td><td>1</td><td colspan="2"></td></tr>
<tr><td colspan="3">H. Lund, McGraw-Hill Recycling Handbook, 2nd Edition Hardcover, The McGraw-Hill Companies, Inc., United Stated of America, 2001.</td><td>1</td><td colspan="2"></td></tr>
<tr><td colspan="3">M. Kljajin, M. Opalić, A. Pintarić: Recikliranje električnih i elektroničkih proizvoda, Sveučilište J. J. Strossmayer u Osijeku i Sveučilište u Zagrebu, 2006.</td><td>1</td><td colspan="2"></td></tr>
<tr><td>Optional literature (at the time of submission of study programme proposal)</td><td colspan="6">- A. Pintarić, T. Filetin: Analiza recikličnosti proizvoda, Zbornik III. međ. simpozija "Gospodarenje otpadom Zagreb 94", Zagreb, 1994, str. 59-68.<br>- Professional Journals. Scientific Journals (Industry and Environment-UNEP ).</td></tr>
<tr><td>Quality assurance methods that</td><td colspan="6">Quality assurance will be performed at three levels:<br>(1) University Level;</td></tr>
</table>

| | |
|---|---|
| ensure the acquisition of exit competences | (2) Faculty Level by Quality Control Committee;<br>(3) Lecturer's Level. |
| Other (as the proposer wishes to add) | |

# Process Design

| NAME OF THE COURSE | Process Design | | | | | |
|---|---|---|---|---|---|---|
| Code | KTB219 | Year of study | 2nd year of graduate study | | | |
| Course teacher | PhD, Nediljka Vukojević Medvidović, associate prof. | Credits (ECTS) | 7.0 | | | |
| Associate teachers | | Type of instruction (number of hours) | L | S | E | F |
| | | | 30 | 30 | | |
| Status of the course | Mandatory | Percentage of application of e-learning | | | | |
| **COURSE DESCRIPTION** | | | | | | |
| Course objectives | Students will know the basic principles and the methodology of process equipment design. They will also acquire knowledge of the methodology used in chemical process industry to evaluate the ultimate commercial feasibility. | | | | | |
| Course enrolment requirements and entry competences required for the course | | | | | | |
| Learning outcomes expected at the level of the course (4 to 10 learning outcomes) | It is expected that the outcome of learning to provide knowledge about:<br>- steps in the design and modification of chemical processes<br>- evaluation of the optimum plant location<br>- process research and development in the laboratory and pilot plant facility<br>- scaling up of process and apparatus of the chemical process industry<br>- selection and design of process equipment<br>- estimation of financial viability of the investment<br>- synthesis, optimization and flowsheet simulation<br>- synthesis of heat exchanger network using pinch analysis<br>- sizing of heat transfer, continuous distillation of multicomponent mixtures, separated, pipelines. | | | | | |
| Course content broken down in detail by weekly class schedule (syllabus) | 1 week: Introduction. Design, optimization, sustainable development. Steps in the design and development of new processing plants. The project leader.<br>2 week: From idea to product. Idea. Preliminary works . A feasibility study . Numerical examples. Process development and evaluation. Selection and design of project equipment. Project engineering. Process engineering. Construction of the plant .<br>3 week: Plant location. Location factors. Methods of evaluation of location factors. Numerical examples.<br>4 week: The process development. Process research in laboratory and industrial scale. | | | | | |

<table>
<tr><td></td><td colspan="6">5 week: Scaling up of process and apparatus of the chemical process industry. Similarity low. Models and scaling up methods in chemical engineering. Numerical examples .<br>6 week: The rating process. The rating of the financial performance of investments. Estimation of investment costs. Estimation of production costs. Methods for the evaluation of financial viability of the investment. Numerical examples.<br>7 week: Process design. Synthesis, optimization and flowsheet simulation. Material and energy balance. Numerical examples.<br>8 week: Synthesis and process integration. A hierarchical approach. Model of onion. A holistic approach to the integration process. Pinch analysis. Synthesis of heat exchanger network by pinch analysis.<br>9 week: A graphical method. Analytical method of temperature intervals . Performance of heat exchanger network above and below pincha. Numerical examples .<br>10 week: Heat transfer. Classification. Analysis of the processes of heat transfer. Calculation of the heat exchanger using the mean logaritam differences of temperature. Calculation of the heat exchanger using heat efficiency.<br>11 week: Sizing the heat exchanger. Heat calculation. Mechanical calculation. Numerical examples.<br>12 week. Determining the optimal thickness of insulation. A numerical example.<br>13 week: Sizing distillation columns. The multicomponent mixtures . The distribution of the components . Vapor-liquid equilibrium. Temperature of boiling and dew point. Calculation of Underwodova parameter θ using Newton's method. Numerical examples.<br>14 week: Sizing the continuous distillation of a multicomponent mixture. The heat duty of the condenser and reboiler. Numerical examples.<br>15 week: Sizing separators. Sizing pipelines. Numerical examples.</td></tr>
<tr><td>Format of instruction</td><td colspan="3">**x** lectures<br>**x** seminars and workshops<br>□exercises<br>□*on line* in entirety<br>□partial e-learning<br>□field work</td><td colspan="3">**x** independent assignments<br>**x** multimedia<br>□laboratory<br>□work with mentor<br>□ (other)</td></tr>
<tr><td>Student responsibilities</td><td colspan="6">Attending lectures is 80%, while seminars 100% of the total hours.</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>3.0</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>2.5</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 colspan="6"></td></tr>
<tr><td>Grading and evaluating student work in class and at the final exam</td><td colspan="6">The entire exam can be applied over the three written evaluation during the semester. Passing threshold is 60%. Students who have not passed evaluation during the semester should attend at the final exam in the regular examination period. Final exam will include written and oral exam. Passing threshold is also 60%. Rating: 60% -70% - satisfactory, 70% -80% - good, 80% -90% very good, 90% -100% - excellent.</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** | |
| | W. D. Seider, J.D. Seader, D. R. Lewin, Product & Process Design Principles, Synthesis, Analysis, and Evaluation, 2nd ed., John Wiley&Sons, Inc., New York [etc.], 2004. | 1 | |
| | R. Smith, Chemical Process Design, McGraw-Hill, New-York, 1995.; | 1 | |
| | W. D. Seider, J.D. Seader, D. R. Lewin, Process Design Principles, Synthesis, Analysis, and Evaluation, John Wiley & Sons, Inc., New York [etc.], 1999. | 1 | |
| | F. Šef, Ž. Olujić, Projektiranje procesnih postrojenja, SKTH/Kemija u industriji, Zageb, 1988.; | 1 | |
| | E. Beer, Priručnik za dimenzioniranje uređaja kemijske procesne industrije, HDKI/Kemija u industriji, Zagreb, 1994.; | 1 | |
| | E. Beer, Destilacija, HDKI /Kemija u industriji, Zagreb, 2006. | 1 | |
| | M.S. Peters and K.D. Timmerhaus, Plant Design and Economics for Chemical Engineers, McGraw-Hill, New York, 2003. | 1 | |
| | A. Bejan, Heat transfer, John Wiley and Sons, Inc., New York, 1993. | 1 | |
| Optional literature (at the time of submission of study programme proposal) | R.H. Perry et al., Perry's Chemical Engineer's Handbook, 7th edition, McGraw-Hill, New York, 1997.; James M. Douglas, Conceptual Design of Chemical Processes, McGraw-Hill, New York, 1988. | | |
| Quality assurance methods that ensure the acquisition of exit competences | Quality assurance will be performed at three levels:<br>(1) University Level; (2) Faculty Level by Quality Control Committee; (3) Lecturer's Level | | |
| Other (as the proposer wishes to add) | Suggestions and reactions of participants during the semester.<br>Student survey. | | |

# Marine and Submarine Mineral Raw Materials

| **NAME OF THE COURSE** | **Marine and Submarine Mineral Raw Materials** | | | | | |
|---|---|---|---|---|---|---|
| Code | KTB220 | Year of study | 2nd | | | |
| Course teacher | | Credits (ECTS) | 5.0 | | | |
| Associate teachers | PhD, Miroslav Labor, associate prof. | Type of instruction (number of hours) | L | S | E | F |
| | | | 30 | 0 | 30 | 0 |
| Status of the course | Elective | Percentage of application of e-learning | | | | |
| **COURSE DESCRIPTION** | | | | | | |
| Course objectives | Through a program of lectures and exercises students acquire knowledge of marine | | | | | |

| | |
|---|---|
| | and submarine mineral resources and their exploitation. |
| 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 are expected to:<br>- explain and distinguish mineral resources of the sea and seabed<br>- describe the methods of exploitation<br>- describe the economic aspects of the exploitation of mineral resources of the sea and seabed<br>- implement "sustainable" development in certain industrial processes |
| Course content broken down in detail by weekly class schedule (syllabus) | 1st week: Minerals expected in beach deposits.<br>2nd week: Submerged beaches.<br>3rd week: Beaches being exploited now and exploration methods.<br>4th week: Mineral raw materials from sea water. Extraction of minerals from seawater: NaCl, magnesium compaunds, bromine, gold etc.<br>5 th week: Production of minerals in conjuction with the desalination of sea water.<br>6 th week: New technologies for mineral extraction from the sea.<br>7 th week: The concentration of elements by marine organisms.<br>8 th week: Superficial deposits of the continental shelf. Phosphate deposites – distribution and exploration.<br>9 th week: Other minerals on the continental shelfves – glauconite, barium sulphate, organic sediments, etc.<br>10 th week: Sediments of the ocean floor. Pelagic sediment. Calcareous and siliceous oozes, red clay and other minerals.<br>11 th week: Manganese nodules. Physical characteristic of the nodules, methods of exploration, concetraction of Mn, Co, Ni, Cu, etc.<br>12 th week: Associated sediments. Effect of ocean-floor currents and animals.<br>13 th week: Mining of superficial sediments from the ocean floor.<br>14 th week: Economic aspect of ocean mining.<br>15 th week: Legal problems involved in ocean mining – law of the sea.<br><br>Exercises:<br>During the practicum, students will gain the practical knowledge about how to prepare raw materials required for the technological process of obtaining magnesium oxide from sea water. List of laboratory exercises:<br>Exercise 1. Determining the optimal amount flocculent at 80% precipitation of magnesium hydroxide from seawater.<br>Exercise 2. Determining the influence the initial concentration of magnesium hydroxide on the sedimentation rate and concentration of the resulting suspension.<br>Exercise 3. Determining the influence the degree of completenes of precipitation on the rate of sedimentation of magnesium hydroxide.<br>Exercise 4. Determination of the optimal degree of completeness precipitation with appropriate quantities of the flocculent added.<br>Exercise 5. Calculation of a continuous thickener applying Kynch theory |
| Format of instruction | **x** lectures<br>☐seminars and workshops<br>**x** exercises<br>☐*on line*in entirety<br>☐partial e-learning<br>☐field work<br>☐independent assignments<br>**x** multimedia<br>**x** laboratory<br>☐work with mentor<br>☐ (other) |
| Student responsibilities | Attendance to lectures for 80% of the total number of hours. Full attendance to exercises (100% of the total number of hours). |

| | | | | | | |
|---|---|---|---|---|---|---|
| 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 | 1.0 | Research | | Practical training | |
| | Experimental work | 1.5 | Report | 0.5 | Field work | |
| | Essay | | Seminar essay | | (Other) | |
| | Tests | | Oral exam | 2.0 | (Other) | |
| | Written exam | | Project | | (Other) | |

| | |
|---|---|
| Grading and evaluating student work in class and at the final exam | Attendance to lectures is registered (not included in the rating). During the semester students have to perform lab exercises. After performing exercises followed by treatment of the experimental results and preparation of reports. Finally completed students take the oral examination of the material covered by the exercises. Experimental part of the work in the lab scored with 30% of the final assessment report after completion of the exercise with 2%, and the final oral exam with 60%. Ratings: 60%-70% – satisfactory, 71%-80% – good, 81%-90% – very good, 91%-100% – excellent. |

| | **Title** | **Number of copies in the library** | **Availability via other media** |
|---|---|---|---|
| Required literature (available in the library and via other media) | K. A. Sverdrup, A. B. Duxbury, A. C. Duxbury, Fundamentals of Oceanography, 5th Edition, McGraw-Hill Companies, 2006. | 1 | |
| | V. Martinac, Magnesium oxide from Seawater, University handbook, (in Croatian), on line (2010-12-13), Faculty of Chemistry and Technology, Split, 2010. | | on line |
| | T. Garrison, Essentials of Oceanography, 6th Edition, Brooks/Cole, USA, 2012. | 1 | |
| | M. J. Kennish, Practical Handbook of Marine Science, 3rd Edition, CRC Press, Boca Raton, 2001. | 1 | |
| | B. Petric, V. Martinac, Marine and submarine mineral raw materials, Laboratory exercises, (in Croatian), Faculty of Technology, Split, 1994. | 10 | |
| | M. Labor, Marine and submarine mineral raw materials, ppt presentation, on line (2014-02-26), (in Croatian), Faculty of Chemistry and Technology, Split, 2014. | | on line |

| | |
|---|---|
| Optional literature (at the time of submission of study programme proposal) | K. Stowe, Exploring Ocean Science, 2nd Edition, Wiley, New York, 1996. Desalination, Trends and Technologies, Ed by M. Schorr (on line 2011-02-28), InTechOpen, 2011. |
| 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) | |

# Direct Energy Conversion

| NAME OF THE COURSE | Direct Energy Conversion | | | | | |
|---|---|---|---|---|---|---|
| Code | KTB218 | Year of study | 2nd | | | |
| Course teacher | PhD, Senka Gudić, 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 | Students will acquire knowledge about possibilities and methods of direct energy conversion. After passing this exam they will be able to select the most useful and suitable energy converter, considering their usage. | | | | | |
| 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 successfully passed exam student is able to:<br>- explain the basic principles of energy conversion<br>- distinguish between the different possibilities of direct energy conversion<br>- calculate the effectiveness of each energy converter<br>- select the most suitable energy converter, considering their usage<br>- apply the knowledge gained in the development and scientific research in this field of science. | | | | | |
| Course content broken down in detail by weekly class schedule (syllabus) | 1st week: Introduction in problem of direct energy conversion. Primary energy sources. Limitations in exploitation of energy. State of energy conversion (review).<br>2nd week: Reasons for direct energy conversion. Principles of energy conversion. Basic definitions and units. Equation for efficiency of conversion.<br>3rd week: Irreversible thermodynamics. Unique theory of energy converter. Device's classification. Construction and manufacturing of energy converter and batteries.<br>4th week: Photoelectric converters. Review principles of radiation. Optical effects at semiconductors and p-n junctions. Application photoelectric effect on p-n junction in solar batteries.<br>5th week: Thermoelectric converters. Solid state description of thermoelectric effects. Energy relations in thermoelectric converter. Energy relations, efficiency and power of the thermoelectric converter. Criteria for selection of thermoelectric materials. Reliability and application of thermoelectric converters.<br>6th week: Thermionic converters. Electron work function and surface phenomena. Role of cesium in thermoionic converter. Thermodynamic analysis of thermoionic converter.<br>7th week: First test. Electrochemical energy conversion. Description of electrochemical system.<br>8th week: Thermodynamic aspects of electrochemical energy conversion. Factor of efficiency. Primary cells – characteristics.<br>9th week: Types of primary cells. Leclanche cell. Zinc chloride cell. Alkaline battery. Silver-oxide cell. Lithium cells. Metal-air cells.<br>10th week: Batteries - characteristics. Lead acid battery. Alkaline systems. Ni-Cd, Ag-Zn, Ni-Zn batteries.<br>11th week: New battery technologies. Nickel-metal hydride battery. Lithium-ion | | | | | |

<table>
<tr><td></td><td colspan="6">battery. Lithium polymer battery.<br>12th week: Fuel cell. Fuel cell as energy converter.<br>13th week: Classification of fuel cell - Review of realized systems and systems in development. Molten-carbonate fuel cell (MCFC). Solid oxide fuel cell (SOFC). Alkaline fuel cell (AFC). Phosphoric acid fuel cell (PAFC).<br>14th week: Proton exchange membrane fuel cell (PEMFC). Direct-methanol (DMFC) and direct-ethanol fuel cell (DEFC). Regenerative fuel cell (RFC).<br>15th week: Second test.<br>Exercises:<br>Determination of efficiency in thermoelectric generator. Characterization of anode materials for aluminum-air batteries. Current-voltage characteristics of PEM fuel cell. Direct energy conversion of solar radiation into electrical energy. Determination of current capacity of Li-ion battery. Charging of lead acid battery.</td></tr>
<tr><td>Format of instruction</td><td colspan="3">× lectures<br>□ seminars and workshops<br>× exercises<br>□ on linein entirety<br>□ partial e-learning<br>□ field work</td><td colspan="3">□ independent assignments<br>× multimedia<br>× laboratory<br>□ work with mentor<br>☐(other)</td></tr>
<tr><td>Student responsibilities</td><td colspan="6">Lecture attendance: 80 %. Laboratory 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>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></td><td>(Other)</td><td></td></tr>
<tr><td>Tests</td><td>1</td><td>Oral exam</td><td>1.5</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 complete exam can be passed through two tests during semester. The passing score is 60 % and the fraction of each test is 40 %. The fraction of laboratory exercises is 20%. In the exam period the student has to attend to written and oral exam. Grades: < 60% insufficient, 60-70% sufficient, 71-80% good, 81-92% very good, 93-100% excellent.</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. Gudić, Elektrokemijski izvori struje, KTF-Split, 2011.</td><td></td><td colspan="2">web</td></tr>
<tr><td colspan="3">R. Decher, Direct Energy Conversion: Fundamentals of Electric Power Production, Oxford University Press, New York, 1997.</td><td>1</td><td colspan="2"></td></tr>
<tr><td colspan="3">R. Decher, Energy Conversion: Systems, Flow Physics, and Engineering, Oxford University Press, New York, 1994</td><td></td><td colspan="2"></td></tr>
<tr><td>Optional literature</td><td colspan="6">A.J. Appleby, Fuel Cells: Trends in Research and Applications, Hemisphere Publishing Corporation, New York, 1987.</td></tr>
<tr><td>Quality assurance methods that ensure the acquisition of exit</td><td colspan="6">- monitoring of students suggestions and reactions during semester<br>- students evaluation organized by University</td></tr>
</table>

| | |
|---|---|
| competences | |
| Other (as the proposer wishes to add) | |

# Wastewater Engineering

| NAME OF THE COURSE | Wastewater Engineering | | | | | |
|---|---|---|---|---|---|---|
| Code | KTB 225 | Year of study | 2nd year of graduate study | | | |
| Course teacher | PhD, Nediljka Vukojević Medvidović, associate prof. | Credits (ECTS) | 5.0 | | | |
| Associate teachers | PhD, Ivona Nuić, assistant | 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 acquire knowledge in the field of wastewater engineering. They will become familiar with the calculation of the state of water ecosystems due to discharge of wastewater, pollution loading calculations, selecting the process and methods of wastewater treatment, the influence of various factors on the process, appropriate calculation procedure for process equipment capacity. |
| Course enrolment requirements and entry competences required for the course | |
| Learning outcomes expected at the level of the course (4 to 10 learning outcomes) | It is expected that the outcome of learning to provide knowledge about:<br>- the impact of pollution on developments in aquatic ecosystems<br>- sources and characteristics of wastewater, the classification of harmful substances, calculation of pollution loading<br>- determination of the possible savings of fresh water and the formation of waste water using water pinch analysis<br>- selection procedures and methods for wastewater treatment<br>- stability and destabilization of colloids<br>- mechanisms of coagulation / flocculation<br>- application of aeration, neutralization, oxidation / reduction and chemical precipitation of wastewater treatment<br>- mechanism and kinetics of aerobic biological wastewater treatment<br>- methods of processing biological sludge<br>- application and significance of advanced wastewater treatment. |
| Course content broken down in detail by weekly class schedule (syllabus) | 1 week: Introduction. The use of water. Hydrologic cycle. Water quality management. Water and Sustainable Development.<br>2 week: The aquatic ecosystem. Events in aquatic ecosystems. The consequences of pollution. Oxygen levels in the water. The kinetics of the aerobic decomposition of organic matter in water.<br>3 week: Wastewater. The origin of the waste water. Contamination and pollution of natural waters. Classification of harmful substances. Specific and nonspecific quality indicators. Sampling methodology. Pollution loading.<br>4 week: The steps of priorities in dealing with wastewater. A hierarchical approach. |

<table>
<tr><td></td><td colspan="6">A holistic approach. Integration processes. Water pinch. A graphical method.<br>5 week: Wastewater treatment. Selection process and processing methods. Numerical examples.<br>6 week: Previous treatment stage. Screening, size reduction, equalization and flotation in waste water treatment.<br>7 week: Removing dispersed and colloidal particles. The separation of suspended solids from wastewater by gravity sedimentation. Designing the sedimentator. Coagulation and flocculation in wastewater treatment. Colloidal systems. Stability and destabilization of colloids. Mechanisms of flocculation.<br>8 week: Application of aeration in wastewater treatment. Neutralization, oxidation / reduction and chemical precipitation in wastewater treatment.<br>9 week: Biological processes for wastewater treatment. The factors of the biological activity of microorganisms. The types of microorganisms. The mechanism and kinetics of aerobic biological wastewater treatment. Calculating the parameters of running processes.<br>10 week: Disinfection of wastewater treatment. Sludge treatment.<br>11 week: Advanced wastewater treatment processes. Application of adsorption in wastewater treatment.<br>12 week: Application of ion exchange in wastewater treatment.<br>13 week. The application of membrane processes in wastewater treatment. Application of advanced oxidation processes in wastewater treatment.<br>14 week: Biological removal of nitrogen and phosphorus.<br>15. week: Constructed wetlands.<br><br>Laboratory exercises:<br>Exercises 1. Removal of zinc from waste water by neutralization and chemical precipitation. The construction of solubility diagram for the system Zn(OH)-$H_2O$, and the determination of optimum pH for the precipitation of $Zn(OH)_2$.<br>Exercises 2. Removal of zinc from waste water by neutralization and chemical precipitation. Calculation of addition of hydrated lime and material balance.<br>Exercises 3. Removal of iron from waste water by oxidation / reduction. Determination of rate constants of the oxidation process of Fe(II).<br>Exercises 4. Removal of colloidal particles dispersed in the water by coagulation / floculation. Test coagulation / flocculation of colloidal particles dispersed in the water jar test. Determination of the optimal addition of coagulant / flocculant.<br>Exercise 5. Characterization of waste water using oxygen as an indicator. Determination of chemical oxygen demand (COD) using Dichromate method. Determination of biochemical oxygen demand (BOD) using Winkler method.<br>Exercise 6. The kinetics of biochemical degradation of organic matter. Datermination of rate constant and inital concentration of organic matter in wastewater.<br>Fieldtrips for visiting of wastewater treatment plants.</td></tr>
<tr><td>Format of instruction</td><td colspan="3">**x** lectures<br>☐ seminars and workshops<br>**x** exercises<br>☐ *on line* in entirety<br>☐ partial e-learning<br>**x** field work</td><td colspan="3">☐independent assignments<br>**x** multimedia<br>**x** laboratory<br>☐work with mentor<br>☐ (other)</td></tr>
<tr><td>Student responsibilities</td><td colspan="6">Attending lectures is 80%, while laboratory exercises and field work 100% of the total hours.</td></tr>
<tr><td>Screening student work(name the</td><td>Class attendance</td><td>1.5</td><td>Research</td><td></td><td>Practical training</td><td></td></tr>
</table>

| | | | | | | |
|---|---|---|---|---|---|---|
| *proportion of ECTS credits for eachactivity so that the total number of ECTS credits is equal to the ECTS value of the course)* | Experimental work | 1.5 | Report | 0.5 | (Other) | |
| | Essay | | Seminar essay | | (Other) | |
| | Tests | 0.5 | Oral exam | 0.5 | (Other) | |
| | Written exam | 0.5 | Project | | (Other) | |

| | | | |
|---|---|---|---|
| Grading and evaluating student work in class and at the final exam | Every laboratory exercises include oral exam before exercise and writing of final report.<br>The entire exam can be applied over the three written evaluation during the semester. Passing threshold is 60%. Students who have not passed written evaluation during the semester should attend at the final exam in the regular examination period. Final exam will include written and oral exam. Passing threshold is also 60%. Rating: 60%-70% - satisfactory, 70%-80% - good, 80%-90% very good, 90%-100% - excellent. | | |
| Required literature (available in the library and via other media) | **Title** | **Number of copies in the library** | **Availability via other media** |
| | D. Hendricks, Water Treatment Unit Processes, CRC Press, Roca Raton [etc.], 2006. | 1 | |
| | S. Tedeschi, Zaštita voda , HDGI, Zagreb, 1997. | 1 | |
| | J. M. Coulson, J. F. Richardson, J. R. Backhurst, J. H. Harker, Chemical Engineering, 5th ed., London, England, 2002. | 1 | |
| | Metcalf & Eddy, Wastewater Engineering, McGraw-Hill, Inc., Boston [etc.], 1991. | 1 | |
| | L. D. Benefield, J. F. Judkins, B. L. Weand, Process Chemistry for Water and Wastewater Treatment, Prentice-Hall, Inc. London [etc.], 1982. | 1 | |
| Optional literature (at the time of submission of study programme proposal) | 1. J. Margeta, Oborinske i otpadne vode: teret onečišćenja i mjere zaštite, Sveučilište u Splitu, Građevinsko-arhitektonski fakultet, Split, 2007.<br>2. B. Tušar, Pročišćavanje otpadne vode, Kigen d.o.o. i Geotehnički fakultet Sveučilišta u Zagrebu, Zagreb, 2009.<br>3. B. Tušar, Ispuštanje i pročišćavanje otpadne vode, Croatia knjiga, Zagreb, 2004. | | |
| Quality assurance methods that ensure the acquisition of exit competences | Quality assurance will be performed at three levels:<br>(1) University Level; (2) Faculty Level by Quality Control Committee; (3) Lecturer's Level | | |
| Other (as the proposer wishes to add) | Suggestions and reactions of participants during the semester.<br>Student survey. | | |

# Naturally Occuring Polymeric Materials

| **NAME OF THE COURSE** | **Naturally Occuring Polymeric Materials** | | | | | | |
|---|---|---|---|---|---|---|---|
| Code | KTB205 | Year of study | 2nd | | | | |
| Course teacher | PhD, Branka Andričić, prof. | Credits (ECTS) | 5.0 | | | | |
| Associate teachers | | Type of instruction | L | S | E | F | |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | (number of hours) | 30 | | | |
| Status of the course | Elective | Percentage of application of e-learning | | | | |
| **COURSE DESCRIPTION** | | | | | | |
| Course objectives | Gaining of 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) | - listing of naturally occurring polymers and their resources<br>- able to explain the structure and properties of naturally occurirng polymers<br>- be acquainted with application fields of naturally occurring polymers<br>- 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.<br>2nd week: Definition of naturally occurring polymers in narrow and broad sense. PLA and PHB: synthesis and properties. Molecular and supermolecular structure of polymers.<br>3rd week: Starch: structure and properties. Modification and application of starch.<br>4th week: Structure and properties of cellulose. Microcrystalline cellulose. Natural cellulose fibres. Mercerization and crosslinking of cotton fibres.<br>5th week: Regenerated cellulose. Cellulose derivates. Alginic acid and alginates. Structure and application of alginates. Ion exchange.<br>6th week: Other polysaccharides. Structure, properties and application of lignin.<br>7th week: Ponavljanje. First test.<br>8th week: Amino acides in proteins. Primary, secondary and tertiary structure of proteins.<br>9th week: Protein fibres. Structure and properties of silk fibre. Structure and properties of wool.<br>10th week: Structure and properties of collagen. Collagen based materials.<br>11th week: Casein: structure, phase separation, application. An overview of natural fibres properties.<br>12th week: Natural caoutchouc. Derivates of natural caoutchouc. Mastication and vulcanization.<br>13th week: Shaping of caoutchouc and production of rubbery products (tires etc.) Reuse and recycling of rubber. Regeneration of caoutchouc<br>14th week: Plastic and rubbery waste management system. Natural resins.<br>15th week: Ponavljanje. Second test.<br><br>Laboratory exercises:<br>1. Preparation of thermoplastic starch<br>2. Regeneration of cellulose. Identification of natural fibres by burning tests.<br>3. Immobilization of bakers yeast on alginate<br>4. Gelatine swelling<br>5. Isolation of casein and preparation of casein glue | | | | | |
| Format of instruction | **X** lectures<br>□ seminars and workshops<br>□ exercises | | □ independent assignments<br>**X** multimedia<br>**X** laboratory | | | |

| | | |
|---|---|---|
| | □ *on line* in entirety<br>□ partial e-learning<br>□ field work | □ work with mentor<br>□ (other) |
| Student responsibilities | | |

| 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 | 1.0 | Research | | Practical training (report on exp. work) | 0.2 |
| | Experimental work | 1.0 | Report | | Tests before experimental work | 0.2 |
| | Essay | | Seminar essay | | (Other) | |
| | Tests | 0.6 | Oral exam | 0.4 | (Other) | |
| | Written exam | 0.6 | Project | | (Other) | |

| | |
|---|---|
| Grading and evaluating student work in class and at the final exam | 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 30%. 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%.<br>Grades: successful (60% – 70%), good (71% – 80%), very good (81% – 90%), excellent (91% – 100%). |

| Required literature (available in the library and via other media) | **Title** | **Number of copies in the library** | **Availability via other media** |
|---|---|---|---|
| | B. Andričić, Prirodni polimerni materijali, Priručnik, Sveučilište u Splitu, Split, 2008. | 1 | KTF web library |

| | |
|---|---|
| Optional literature (at the time of submission of study programme proposal) | C. E. Carracher, Seymour/Carraher's Polymer Chemistry, 4th Ed., Marcel Dekker, New York, 1996. |
| 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) | |

# Introduction to Scientific Research

| **NAME OF THE COURSE** | **INTRODUCTION TO SCIENTIFIC RESEARCH** | | | | | |
|---|---|---|---|---|---|---|
| **Code** | | Year of study | 2. | | | |
| Course teacher | PhD Marina Trgo, prof. | Credits (ECTS) | 3.0 | | | |
| Associate teachers | PhD Marin Ugrina | Type of instruction (number of hours) | P | P | P | P |
| | | | 15 | 15 | 0 | 0 |
| Status of the course | Mandatory | Percentage of application of e-learning | | | | |

| COURSE DESCRIPTION | | |
|---|---|---|
| Course objectives | The aim of the course is to train students for the organization of scientific research, to master the principles and methodology of data collection and literature, the way of processing and data analysis and presentation of results according to the principles of ethical responsibility in the natural, technical and biotechnological sciences. | |
| Course enrolment requirements and entry competences required for the course | | |
| Learning outcomes expected at the level of the course (4 to 10 learning outcomes) | It is expected that the learning outcomes provide knowledge about:<br>- understanding of the importance of science and scientific research<br>- types of scientific fields and branches of science, scientific institutions and professions<br>- legislation in science<br>- way to search and use bibliographic databases and other sources of scientific information<br>- organization and implementation of scientific research<br>- understanding of the structure and meaning parts of scientific work<br>- analyse scientific issues and interpretation of results<br>- independent design of scientific work at writing, technical processing, presentation, and presentation<br>- ethical responsibility in scientific research. | |
| Course content broken down in detail by weekly class schedule (syllabus) | 1st week: Introductory lecture. The historical development of science. Scientific knowledge.<br>2nd week: Science and legislation (fields and branches of science, scientific institutions, organizations, programs, declarations, scientific degrees)<br>3rd week: Classification and type of papers. The aims and purposes of scientific paper. Differences between the scientific and professional paper.<br>4th week: Components of scientific work (spot the problem, study the problem, set up a hypothesis, design research, conduct research and process the results, confirm or reject the hypothesis, to publish the results)<br>5 th week: Sources of information. The literature search. Database.<br>6 th week: Experiment. The organization of work in the field and in the laboratory. Planning, implementation and testing.<br>7 th week: Processing the results: sorting, statistics, modelling.<br>8 th week: Writing an article (scientific, professional, review, scientific and popular).<br>9 th week: Presentation of research. Poster presentations.<br>10 th week: Presentation of research. Oral presentation. Basic principles in the presentation of work.<br>11th week: References. The use of computer technique in the citation.<br>12 th week: Keywords. Graphical abstract.<br>13 th week: Applications for the expert and scientific conferences. The publication of the article. Reviews of scientific papers.<br>14 th week: Measure the value of articles (citations, indexing, impact factor).<br>15 th week: Scientific research ethics.<br>Seminar: writing seminar paper, making poster presentations, making a PowerPoint presentation of the paper and oral presentation. | |
| Format of | ☒ lectures | ☒ independent assignments |

<table>
<tr><td>instruction</td><td colspan="3">☒ seminars and workshops<br>☐ exercises<br>☐ on line in entirety<br>☐ partial e-learning<br>☐ field work</td><td colspan="3">☒ multimedia<br>☐ laboratory<br>☐ work with mentor<br>☐ (other)</td></tr>
<tr><td>Student responsibilities</td><td colspan="6">Attending lectures is 80%, while seminars 100% of the total hours.</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>(Other)</td><td></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>1.0</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 colspan="6"></td></tr>
<tr><td>Grading and evaluating student work in class and at the final exam</td><td colspan="6">Final written exam or two partial exams (50% of the total evaluation).<br>A written essay (25% of the total evaluation).<br>Oral presentation of written seminar paper (20% of the total evaluation) and poster presentation based on a written seminar paper (5% of the total evaluation). Passing threshold is 60%. Grades: successful (60% – 69%), good (70% – 79%), very good (80% – 89%), excellent (90% – 100%).</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">M. Marušić i suradnici, Uvod u znanstveni rad u medicini, 5. izdanje, Zagreb, Medicinska naklada, 2013.</td><td>1</td><td colspan="2"></td></tr>
<tr><td colspan="3">V. Silborčić, Kako sastaviti, objaviti i ocijeniti znanstveno djelo, Zagreb, Medicinska naklada, 2003.</td><td>1</td><td colspan="2"></td></tr>
<tr><td colspan="3">J. Kniewald, Metodika znanstvenog rada, Zagreb, Multigraf, 1993.</td><td>1</td><td colspan="2"></td></tr>
<tr><td>Optional literature (at the time of submission of study programme proposal)</td><td colspan="6">A. Tkalac Verčić, Dubravka Sinčić Ćorić, Nina Pološki Vokić, Priručnik za metodologiju istraživačkog rada, Zagreb, M.E. P. d.o.o., 2010.<br>M. I. Miljević, Metodologija naučnog rada, Sarajevo, Univerzitet u istočnom Sarajevu, Filozofski fakultet, 2007.<br>Z. V. Popović, Kako napisati i objaviti naučno delo, Beograd, Akademska misao, 2004.</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:<br>(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">Suggestions and reactions of participants during the semester.<br>Student survey.</td></tr>
</table>

# Catalysis in Enviromental Protection

| NAME OF THE COURSE | CATALYSIS IN ENVIRONMENTAL PROTECTION | | | | | |
|---|---|---|---|---|---|---|
| Code | KTC107 | Year of study | 1st | | | |
| Course teacher | Branka Andričić | Credits (ECTS) | 4.5 | | | |
| Associate teachers | | Type of instruction (number of hours) | L | S | E | F |
| | | | 30 | 15 | 0 | 0 |
| Status of the course | Mandatory | Percentage of application of e-learning | | | | |
| **COURSE DESCRIPTION** | | | | | | |
| Course objectives | Strengthening the knowledge about catalysis and catalysts as well as the overview of the catalyst preparation methods. Insight in modern methods of pollution control and „green“ chemical catalytic processes. | | | | | |
| Course enrolment requirements and entry competences required for the course | | | | | | |
| Learning outcomes expected at the level of the course (4 to 10 learning outcomes) | - detailed explanation of the principle of catalyst role in chemical reaction<br>- distinguish homogeneous and heterogeneous catalysts<br>- distinguish the basic components of heterogeneous catalytic system<br>- recognition of the different catalysts in real systems (stationary and mobile sources of emissions)<br>- ability to explain the importance of catalysts applications in industry and the concept of sustainable development. | | | | | |
| Course content broken down in detail by weekly class schedule (syllabus) | 1st week: Presentation of learning outcomes of the course. Environmental pollution and “clean” energy. Importance of catalysis.<br>2nd week: Basic principles of catalysts role in chemical reactions (activity, selectivity, stability).Heterogeneous catalysis: reaction steps. Physical and chemical adsorption (Lenard-Jones diagram). Basic laws of adsorption.<br>3rd week: Mechanism and kinetics of heterogeneous catalytic reactions. Heterogeneous catalytic system: carriers, promoters, activators, moderators and inhibitors.<br>4th week: Preparation of heterogeneous catalysts (precipitation, impregnation, skeletal catalysts, monoliths).<br>5th week: Durability of catalysts and deactivation resistance. Causes of catalysts deactivation.<br>6th week: Catalytic oxidation of VOC (traditional industrial processes, air clean-up).<br>7th week: NOx reductions: nonselective and selective catalytic reduction. An overview of lectures.<br>8th week: First test.<br>9th week: Emissions from stationary sources. CH abatement procedures. Low temperature CO oxidation.<br>10th week: Emission control from gasoline engines (engine construction, emissions and regulations, catalytic conversion).<br>11th week: Emission control from diesel engines (engine construction, emissions and regulations, particulate filters, catalysts for diesel engines).<br>12th week: Zeolites as the catalysts in environmental protection (structure and application in industrial processes and environmental protection).<br>13th week: The role of catalysts in chemical recycling of waste plastics (catalytic cracking to gasoline, diesel, kerosene, fuel oils, monomers and other chemicals.)<br>14th week: An overview of lectures. Discussion about some examples from practice. | | | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| | 15th week: Second test. | | | | | |
| Format of instruction | **X** lectures<br>**X** seminars and workshops<br>□ exercises<br>□ *on line* in entirety<br>□ partial e-learning<br>□ field work | | **X** independent assignments<br>**X** multimedia<br>□ laboratory<br>□ work with mentor<br>□ (other) | | | |
| Student responsibilities | | | | | | |
| 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 | 1.5 | Research | | Practical training (report on exp. work) | |
| | Experimental work | | Report | | Tests before experimental work | |
| | Essay | | Seminar essay | 0.5 | Field work | |
| | Tests | 0.9 | Oral exam | 0.7 | (Other) | |
| | Written exam | 0.9 | Project | | (Other) | |
| Grading and evaluating student work in class and at the final exam | The complete exam can be passed through two tests during the semester. The passing score is 60 % and the fraction of each test is 45%. At least 80 % class attendance during the lectures gives additional 10% of final grade.<br>In the exam period the student has to attend to written and oral exam (passing score is 60%). Written exam is 50% and oral exam is 50%.<br>Grades: successful (60% – 70%), good (71% – 80%), very good (81% – 90%), excellent (91% – 100%). | | | | | |
| Required literature (available in the library and via other media) | **Title** | | | | **Number of copies in the library** | **Availability via other media** |
| | 1. T. Kovačić, B. Andričić, Kataliza, Internal papers, KTF, Split, 2010.<br>2. R. M. Heck, R. J. Farrauto, Catalytic Air Pollution Control, J. Wiley & Sons, Hoboken, 2012 | | | | 1<br>1 | KTF Web library<br>Library |
| Optional literature (at the time of submission of study programme proposal) | 1. F. J. J. G. Janssen, R. A. van Santen, Environmental Catalysis, Imperial Colledge Press, London, 1999<br>2. Scientific and professional articles | | | | | |
| 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) | | | | | | |

# Electrochemical Technologies in Environmental Protection

| | |
|---|---|
| **NAME OF THE COURSE** | **ELECTROCHEMICAL TECHNOLOGIES IN ENVIRONMENTAL** |

| | | | | | | |
|---|---|---|---|---|---|---|
| | **PROTECTION** | | | | | |
| Code | KTC 108 | Year of study | 1. | | | |
| Course teacher | Ph.D. Senka Gudić, full professor | Credits (ECTS) | 5.0 | | | |
| Associate teachers | | Type of instruction (number of hours) | L | S | E | F |
| | | | 30 | 15 | 15 | |
| Status of the course | Mandatory | Percentage of application of e-learning | | | | |

**COURSE DESCRIPTION**

| | |
|---|---|
| Course objectives | Gaining knowledge about the basic laws of electrolysis and electrochemical kinetics which play an important role in materials science and materials engineering, corrosion protection of materials, electroorganic and inorganic synthesis processes and also in modern and sustainable electrochemical technologies in environmental protection. |
| 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:<br>- design and optimize electrochemical reactor,<br>- explain the electrochemical aspects of environmental protection,<br>- identify the benefits and limitations of electrochemical technology in environmental protection,<br>- explain the electrochemical processes of wastewater treatment and organic waste treatment,<br>- explain the electrochemical processes of gases purification and remediation of soil,<br>- apply the electrochemical sensors in the engineering environment. |
| Course content broken down in detail by weekly class schedule (syllabus) | 1st week: Introduction. Electrochemical systems. Electrode/electrolyte interface.<br>2nd week: Mechanism and kinetics of electrode processes.<br>3rd week: Optimization of electrochemical reactor design. Electrochemical processes control.<br>4th week: Electrochemical technologies in environmental protection - advantages and limitations. Economic analysis.<br>5th week: Electrochemical processes for water treatment and organic pollutants. Anodic processes. Anodic material selection. Dimensionally stable anodes. Direct electrochemical oxidation of toxic organic compounds (complete decomposition to $CO_2$) and inorganic compounds (cyanide and thiocyanate).<br>6th week: Indirect electrochemical oxidation (IEO) of toxic organic compounds. IEO mechanism. Oxidizing agent formation. Electro-Fenton process.<br>7th week: Anodic removal of pesticides. Pollutant removal from organic mixtures - Selected process. Cathodic processes. Cathodic material selection.<br>8th week: Cathodic reduction of heavy metal ions. Direct electrochemical reduction of perchlorate, nitrate, chromate. Cathodic dechlorination of organic waste.<br>9th week: First test. Membrane-based electrochemical processes: Electrodialysis, Salt splitting.<br>10th week: Electrochemical gas purification. Electrode for direct and indirect gas purification. Removal of $CO_2$, $NO_x$, $SO_2$, $H_2S$. New process developments.<br>11th week: Electrochemical remediation of soil. Removal of ionic impurities. Electrokinetic removal of organic compounds. Economic analysis and benefits of |

<table>
<tr><td></td><td colspan="6">electrochemical soil remediation.<br>12th week: Electrochemical sensors in environmental engineering. Improved electrochemical processes and products.<br>13th week: Electrochemical power sources for cleaner electrical energy.<br>14th week: Photoelectrochemical methods for removal of organic, inorganic and microbiological contamination of the water.<br>15th week: Second test.<br>Exercises: Electrolyte decomposition voltage. Electrogravimetric analysis. Electrorefining of silver. Direct electrochemical oxidation of phenolic compounds. Electro-Fenton process to remove organic compounds. Direct electrochemical reduction of nitrate. Cathodic reduction of heavy metal ions. Indirect reduction of perchlorate.</td></tr>
<tr><td>Format of instruction</td><td colspan="3">× lectures<br>× seminars and workshops<br>× exercises<br>□ on linein entirety<br>□ partial e-learning<br>□ field work</td><td colspan="3">□ independent assignments<br>× multimedia<br>□ laboratory<br>□ work with mentor<br>☐(other)</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 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>0.5</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</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>Grading and evaluating student work in class and at the final exam</td><td colspan="6">The complete exam can be passed through three tests during semester. The passing score is 60 % and the fraction of each test is 33 %. In the exam period the student has to attend to written and oral exam. Grades: < 60% insufficient, 60-70% sufficient, 71-80% good, 81-92% very good, 93-100% 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 colspan="2">Availability via other media</td></tr>
<tr><td colspan="3">A. Despić, Osnove elektrokemije 2000, Zavod za udžbenike i nastavna sredstva, Beograd, 2003.</td><td></td><td colspan="2"></td></tr>
<tr><td colspan="3">J.O'M. Bockris, A.K.N. Reddy, M. Gamboa-Aldeco, Modern Electrochemistry 2A, Fundamentals of Electrodics, 2nd Edition, Kluwer Academic/Plenum Publishers, New York, 2000.</td><td>1</td><td colspan="2"></td></tr>
<tr><td colspan="3">Environmental Oriented Electrochemistry, 1st Edition, C. Sequeira (Ed.), eBook, Elsevier Ssience.</td><td></td><td colspan="2"></td></tr>
<tr><td colspan="3">Electrochemistry for the Environment Comninellis, Christos, Chen, Guohua (Eds.) 2010.</td><td></td><td colspan="2"></td></tr>
<tr><td>Optional literature</td><td colspan="6">C. H. Hamann, A. Hamnett, W. Vielstich, Electrochemistry, Wiley-VCH Weinheim, 1998.</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:<br>(1) University Level;<br>(2) Faculty Level by Quality Control Committee;<br>(3) Lecturer’s Level.</td></tr>
</table>

| | |
|---|---|
| Other (as the proposer wishes to add) | |

# Measurment and Automatic Process Control

| NAME OF THE COURSE | MEASUREMENT AND AUTOMATIC PROCESS CONTROL | | | | | |
|---|---|---|---|---|---|---|
| Code | KTC 109 | Year of study | 1. | | | |
| Course teacher | Nenad Kuzmanić | Credits (ECTS) | 4.5 | | | |
| Associate teachers | Antonija Kaćunić | Type of instruction (number of hours) | P | S | V | T |
| | | | 30 | 0 | 8 | 7 |
| Status of the course | Mandatory | Percentage of application of e-learning | 0 | | | |
| **COURSE DESCRIPTION** | | | | | | |
| Course objectives | The objective is to familiarize students with process measurements, metrology, and metrology infrastructure as well as with different methods of automatic process control in environmental protection 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) | After passing the exam, student is expected to be able to:<br>• analyze the importance of measuring process variables for the purpose of process control,<br>• select an appropriate measuring instrument for the purpose of process control<br>• in different segments of environmental protection engineering,<br>• understand the basic concepts of the process control theory,<br>• define and explain the role of the basic components of automatic control system,<br>• calculate the basic data needed to run a system as well as to predict its dynamic behavior. | | | | | |
| Course content broken down in detail by weekly class schedule (syllabus) | Week 1: The basic principles of measurement systems used for process control in environmental protection engineering. Control loop, elements of the control loop.<br>Week 2: Development of dynamic models of the process.<br>Week 3: Measuring sensor and transmitter and their general features.<br>Week 4: Calibration of measuring instruments to national standards. Repeatability and reproducibility of measurements.<br>Week 5: Temperature sensors and transducers. Pressure sensors and transducers.<br>Week 6: Flow sensors and transducers. Level sensors and transducers.<br>Week 7: Control of physical variables in a bioreactor (temperature, pressure, flow, level).<br>Week 8: Monitoring and control of chemical and biological indicators of the state of a bioprocesse in bioreactors (pH, redox potential, dissolved oxygen, CO2 ...).<br>Week 9: Proportional, integral, and derivative actions of a controller. Control loop design. P & ID diagrams.<br>Week 10: Basic terms, means and methods of process control. Automatic stabilization. Sequential control. Feedback and feedforward control.<br>Week 11: Process control methods: cascade, feedforward and multivariable | | | | | |

<table>
<tr><td></td><td colspan="6">process control.<br>Week 12: Modern industrial controllers. Instruments management system. Control valves.<br>Week 13: The use of artificial intelligence algorithms for monitoring and control in biotechnological processes.<br>Week 14: Modern control systems. Distributed control systems. Process control of batch and continuous processes.<br>Week 15: Examples of process control in environmental protection engineering.</td></tr>
<tr><td>Format of instruction</td><td colspan="3">X lectures<br>□ seminars and workshops<br>X exercises<br>□ on line in entirety<br>□ partial e-learning<br>☐field work</td><td colspan="3">X independent assignments<br>X multimedia<br>X laboratory<br>□ work with mentor<br>□ (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>1.5</td><td>Research</td><td></td><td>Practical training</td><td>1.5</td></tr>
<tr><td></td><td></td><td>Report</td><td></td><td>Exercises tests study (Other)</td><td></td></tr>
<tr><td>Essay</td><td></td><td>Seminar essay</td><td></td><td>Report from the exercises (Other)</td><td></td></tr>
<tr><td>Tests</td><td></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></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">A student can pass a part or the entire exam by taking two partial tests during the semester. In order to pass the test, student should achieve a minimum score of 55%. Final grade is based on an average of the scores on both tests: 55%-66% - satisfactory, 67%-78% - good, 79%-89% -very good, 90%-100% - excellent.<br>Students who do not pass partial tests have to take an exam in a regular examination periods. Final grade is determined by previously notated criteria.</td></tr>
<tr><td rowspan="4">Required literature (available in the library and via other media)</td><td colspan="4"></td><td></td><td></td></tr>
<tr><td colspan="4">Božičević, J. (1992). Temelji automatike I i II, Školska knjiga, Zagreb</td><td>6</td><td>-</td></tr>
<tr><td colspan="4">R. Žanetić, Vođenje procesa u proizvodnji, Interna skripta, KTF, Split, 2006.</td><td>0</td><td>Web page KTF</td></tr>
<tr><td colspan="4">R. Žanetič, R. Stipišić, Mjerni pretvornici u procesnoj industriji, Interna skripta, KTF, Split, 2005.</td><td>0</td><td>Web page KTF</td></tr>
<tr><td>Optional literature (at the time of submission of study programme proposal)</td><td colspan="6">N. Bolf, Mjerenja i automatsko vođenje procesa, Interna skripta, FKIT, Zagreb, 2007.<br>N. Prljača, Z. Šehić, Automatsko upravljanje: analiza i dizajn. Mikroštampa, Tuzla, 2008.<br>J. Marasović, Temeljni postupci u automatici, Interna skripta, FESB, Split, 2001.<br>D. E. Seborg, T. F. Edgar, D. A. Mellichamp, Process Dynamics and Control, 2nd Edition, Willey International, New Jersey, 2003.<br>T. Marlin, Process Control: Designing Processes and Control Systems for Dynamic Performance, 2nd Edition, McGraw-Hill Science, New York, 2000.</td></tr>
<tr><td>Quality assurance methods that ensure the acquisition of exit competences</td><td colspan="6">Quality and success will be monitored on three levels:<br>(1) University level, (2) faculty level and (3) teacher level.</td></tr>
<tr><td>Other (as the proposer wishes to</td><td colspan="6"></td></tr>
</table>

| | |
|---|---|
| add) | |

# Biochemistry

| NAME OF THE COURSE | BIOCHEMISTRY | | | | | |
|---|---|---|---|---|---|---|
| Code | KTC 110 | Year of study | 1st | | | |
| Course teacher | PhD Olivera Politeo, Associate Professor | Credits (ECTS) | 6 ECTS | | | |
| Associate teachers | PhD Ivana Carev<br>PhD Franko Burčul | Type of instruction (number of hours) | P | S | V | T |
| | | | 30 | 15 | 30 | 0 |
| Status of the course | mandatory | Percentage of application of e-learning | 0 | | | |
| **COURSE DESCRIPTION** | | | | | | |
| Course objectives | Acquisition a basic knowledge and skills in the field of biochemistry | | | | | |
| 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, student is expected to be able to:<br>• Understand the basic principles of protein structure and the impact of their structure on biological function.<br>• Understand the basic principles of enzyme kinetics and enzyme inhibition.<br>• Understand the importance of carbohydrate structures in the living system.<br>• Understand the importance of lipid structures in living system.<br>• Explain the structure and role of biological membranes.<br>• Understand the structure and biological function of nucleic acids. | | | | | |
| Course content broken down in detail by weekly class schedule (syllabus) | **LECTURES:**<br>The history of biochemistry. The origin of life. (2) Water, bioelements, biomolecules and chemical bonds in living organisms. (2). Amino acids (1). Buffers & Buffer systems. (1). Proteins. Protein conformation. (2) Protein sequencing. (1) Protein function. Collagen & Elastin. Hemoglobin & Myoglobin. (2) Isolation and characterisation of proteins. (2) Enzymes. Enzyme kinetics. Enzyme inhibition. (2) Regulation of enzyme activity. (1) Coenzymes and Cofactors. (1) Carbohydrates. (2) Lipids. Lipoproteins. Steroids. (2). Biological membranes. Transport across membranes. (2) Nucleotides and nucleic acids. DNA replication. Transcription. Translation (3) Protein modifications and protein transport. (1) Bioenergetics. Energy-reach compounds: phosphate compounds and ATP. (3) | | | | | |

| | |
|---|---|
| | **SEMINARS:**<br>Buffers & Buffer systems. (3) Amino acids and peptides. (3) ) Enzymes. Enzyme kinetics. Enzyme inhibition. (3) Coenzymes (1) Carbohydrates (1) Lipids. (1) Biological membranes. (1) ) Nucleotides and nucleic acids (1) Bioenergetics. (1)<br><br>**EXERCISES:**<br>Izolacija i kvantitativno određivanje nukleinskih kiselina iz biljnih tkiva (3) The potentiometric titration of amino acids (3) Qualitative analysis of proteins (3) Quantitative determination of proteins by Bradford method. (3) Protein electrophoresis (3) The enzyme kinetics: determination vmax and Km. (3) Enzyme catalysis - effect of inhibitors on enzyme activity (3) The properties of carbohydrates and qualitative tests for carbohydrates (3) Properties of lipids, solubility, saponification (3) Lipid-isolation and detection of phospholipids from egg yolk (3) Isolation and quantification of nucleic acids from plant material (3) |

| | | |
|---|---|---|
| Format of instruction | X lectures<br>x seminars and workshops<br>x exercises<br>□ *on line* in entirety<br>□ partial e-learning<br>☐ field work | □ independent assignments<br>□ multimedia<br>□ laboratory<br>□ work with mentor<br>☐ (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 | 0,5 | Report | | Exercises tests study (Other) | |
| | Essay | | Seminar essay | 1 | Report from the exercises (Other) | |
| | Tests | 2 | Oral exam | 1 | (Other) | |
| | Written exam | 1 | Project | | (Other) | |

| | | | |
|---|---|---|---|
| Grading and evaluating student work in class and at the final exam | | | |
| Required literature (available in the library and via other media) | | | |
| | J.M. Berg, J.L. Tymoczko, L. Stryer: *Biokemija*, 5th Ed, Školska knjiga Zagreb, 2013. | 5 | |
| | R.M.Murray i sur: *Harperova ilustrurana biokemija*, 28th Ed, Medicinska naklada, Zagreb 2011. | 3 | |
| | G. M. Cooper, *Stanica: molekularni pristup*, Medicinska naklada, Zagreb, 2004. | 5 | |
| | S K Sawhney, R ingh: *Introductory Practical Biochemistry.* Alpha Science International Ltd., Harrow, U.K. 2008. | 1 | |
| | Olivera Politeo: *Biokemijski praktikum*, interni materijal. | web | |
| Optional literature (at the time of submission of study programme | | | |

| | |
|---|---|
| proposal) | |
| Quality assurance methods that ensure the acquisition of exit competences | Quality and success will be monitored on three levels:<br>(1) University level, (2) faculty level and (3) teacher level. |
| Other (as the proposer wishes to add) | |

# Environmental Process Engineering

| NAME OF THE COURSE | ENVIRONMENTAL PROCESS ENGINEERING | | | | | |
|---|---|---|---|---|---|---|
| Code | KTC 106 | Year of study | 1st | | | |
| Course teacher | Nenad Kuzmanić | Credits (ECTS) | 7.0 | | | |
| Associate teachers | Antonija Kaćunić, B.Sc. | Type of instruction (number of hours) | L | S | E | F |
| | | | 45 | 15 | 30 | |
| Status of the course | Mandatory | Percentage of application of e-learning | - | | | |
| **COURSE DESCRIPTION** | | | | | | |
| Course objectives | Students are introduced to the theoretical concepts and the application of unit operations in environmental engineering that are necessary in a systematic problem solving of procedures related to the waste treatment. Acquired knowledge allows them to evaluate and select the optimal separation process and introduces them to equipment designing with a special emphasis on optimizing the process operating conditions. | | | | | |
| 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, the student are expected to:<br>understand the concept of sustainable development and to know how to connect the causes of pollution in the environment to the possibilities of its reduction by applying a certain specific environmental engineering process operations,<br>acquire the basic theoretical knowledge of an advanced separation processes that are applied in environmental engineering,<br>know how to apply a basic methodology of chemical engineering necessary in a selection of an appropriate processes and devices used in environmental engineering and to define and optimize the process parameters to increase process efficiency,<br>develop a critical approach towards a certain procedures in environmental engineering in terms of their selection, advantages, disadvantages and applications,<br>adopt a methodological approach in device designing that are used in environmental engineering. | | | | | |
| Course content broken down in detail by weekly class schedule (syllabus) | 1st. week: Interaction between human and environment. Natural and anthropogenic factors causing land pollution. The role of environmental engineering. Principles of sustainable development.<br>2nd. week: Separation processes in environmental engineering. Elementary | | | | | |

| | |
|---|---|
| | principles of separation operations. Mechanical separations processes. Separation processes which include mass and heat transfer.<br><br>3rd. week: Structure and properties of dispersed systems. Working principles of separators. Effectiveness of separation. Product purity and yield.<br><br>4th. week: Separation based on the motion of particles through fluids. Gravity settling processes. Batch sedimentation. Rate of sedimentation. Equipment for gravity sedimentation. Sedimentation zones in continuous thickeners. Clarifier and thickener design.<br><br>5th. week: Aerated and non-aerated grit chambers. Design of grit chambers. Bar screens - types and applications. The removal of oil from wastewater by natural and by air flotation.<br><br>6th. week: Centrifugal settling processes. Principles of centrifugal sedimentation. Equipments for centrifugal sedimentation. Centrifugal decanters (tubular centrifuge, disk centrifuge, helical-conveyor centrifuge). Hydrocyclone. Centrifugal filters. Choice of centrifuge.<br><br>7th. week: Oil spill removal from aquatic environments. Behavior and effects of oil spills on the water. Spread prevention of oil spills. Booms (floating barriers) - types and application.<br><br>8th. week: Mechanical, physical and chemical methods for oil spills removal from aquatic environments. Oil skimmers.<br><br>9th. week: Aeration - principles and practice. Interphase mass transfer. Application of oxygen transfer in wastewater engineering. Equalization.<br><br>10th. week: Aerated biofilters. Aeration in biological wastewater treatment systems. Design and optimization of aeration.<br><br>11th. week: Fundamentals of solid-gas separation. Separation by rotating flow (cyclone). Flow field in a cyclone. Collection efficiency and design of cyclones. Solid-gas filtration and types of filters. Electrostatic precipitation. Mechanism of an electrostatic precipitator. Mechanisms of scrubbing and types of scrubbers<br><br>12th. week: Basic concepts of adsorption. Engineered adsorption processes in water treatment. Adsorption kinetics. Adsorber design.<br><br>13th. week: Crystallization - elementary principles. Nucleation. Crystal growth theories. Influence of process parameters on final product of crystallization. Crystallizer equipments.<br><br>14th. week: Membrane separation processes. Advantage and disadvantage of the membrane separation. Membrane types. Membrane selectivity. Mechanism of mass transfer across the membrane. Product purity and yield.<br><br>15th. week: Membrane structure. Flow patterns in membrane separators. Concentration polarization. Elementary principles of ultrafiltration, electrodialysis and reverse osmosis.<br><br>Exercises:<br>Laboratory exercises:<br>Granulometric characterization of dispersed systems by analytical functions. Gravity settling processes - determination of sedimentation rate of suspension. Geometric characteristics determination of gravity settling separator. Aeration - interphase |

<table>
<tr><td></td><td colspan="6">mass transfer rate. Impact of process parameters on final product of crystallization. Membrane separation process - reverse osmosis water demineralization.<br><br>Field exercises:<br>Optimization of operating conditions of aerated oil and grit chambers (wastewater treatment plant Stupe - Stobreč). Determination of the suspension flow in a centrifuge with a helical-conveyor (treatment plant oily water Cian - Solin). Oil removal from water surface (oily water treatment plant Cian - Solin). Equipment for gravity sedimentation (wastewater treatment plants Sinj and Trilj). Aeration and its application in biological wastewater treatment (wastewater treatment plant Trilj). Solid-gas filtration: process parameters control of the bag filters (CEMEX - Kastel Sućurac)</td></tr>
<tr><td>Format of instruction</td><td colspan="3">X lectures<br>X seminars and workshops<br>X exercises<br>☐ on line in entirety<br>☐ partial e-learning<br>X field work</td><td colspan="3">☐ independent assignments<br>X multimedia<br>X laboratory<br>☐ work with mentor<br>X seminars</td></tr>
<tr><td>Student responsibilities</td><td colspan="6">Lecture attendance: 80 %. Laboratory 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>4.0</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>Exercises tests study (Other)</td><td></td></tr>
<tr><td>Essay</td><td></td><td>Seminar essay</td><td></td><td>Field work (Other)</td><td></td></tr>
<tr><td>Tests</td><td></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></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 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 periods. The exam consists the theoretical (oral) part. Oral part will constitute 70%, laboratory and field exercises will constitute 30% of the final score.</td></tr>
<tr><td rowspan="6">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">W.L. McCabe, J.C. Smith, P. Harriott, Unit Operations of Chemical Engineering, McGraw-Hill, 6th edition, New York, 2001.</td><td>3</td><td colspan="2"></td></tr>
<tr><td colspan="3">T.D. Reynolds, P. Richards, R. Reynolds, Unit Operations and Processes in Environmental Engineering, Brooks Cole, New York, 1995.</td><td>1</td><td colspan="2"></td></tr>
<tr><td colspan="3">E.E, Baruth, Water Treatment Plant Design, McGraw-Hill, 4th edition, New York, 2005.</td><td>1</td><td colspan="2"></td></tr>
<tr><td colspan="3">R.H. Perry, D.W. Green, J.O. Maloney, Perry’s Chemical Engineer’s Handbook, 7th edition, McGraw-Hill, New York, 1999.</td><td>3</td><td colspan="2"></td></tr>
<tr><td colspan="3">M. Hraste, Mehaničko procesno inženjerstvo, HINUS, Zagreb, 2003.</td><td>10</td><td colspan="2"></td></tr>
<tr><td>Optional literature (at the time of submission of study programme</td><td colspan="6">1. S. Tedeschi, Zaštita voda, Sveučilište u Zagrebu, Zagreb, 1997.;<br>2. V. Koharić, Mehaničke operacije, Sveučilište u Zagrebu, Zagreb, 1996.;<br>3. E. Beer, Priručnik za dimenzioniranje uređaja kemijske procesne industrije, HDKI/Kemija u industriji, Zagreb, 1994.</td></tr>
</table>

| | |
|---|---|
| proposal) | |
| Quality assurance methods that ensure the acquisition of exit competences | - monitoring of students suggestions and reactions during semester<br>- students evaluation organized by University |
| Other (as the proposer wishes to add) | |

# Sustainable Technologies and Development

| **NAME OF THE COURSE** | **Sustainable Technologies and Development** | | | | | |
|---|---|---|---|---|---|---|
| Code | KTC111 | Year of study | 1. | | | |
| Course teacher | Dr Jelica Zelić, full professor tenure | Credits (ECTS) | 4.5 | | | |
| Associate teachers | Dr Mario Nikola Mužek | Type of instruction (number of hours) | P | S | V | T |
| | | | 30 | 15 | 0 | 0 |
| Status of the course | Mandatory | Percentage of application of e-learning | 0% | | | |
| **COURSE DESCRIPTION** | | | | | | |
| Course objectives | The application of preventive environmental strategies in the chemical and technological (manufacturing) processes, products and activities, according to the principle: cleaner production - sustainable development, in order to increase production efficiency and reduce risks to the environment and human health. | | | | | |
| Course enrolment requirements and entry competences required for the course | Selected Processes of Chemical Industry | | | | | |
| Learning outcomes expected at the level of the course (4 to 10 learning outcomes) | After passing the exam, student is expected to be able to:<br>• assess contemporary environmental problems<br>• describe the concept and principles of sustainable technology and development<br>• apply the principle of cleaner production - sustainable development in some industrial processes<br>• propose an energy efficient and completed technological process<br>• organize the implementation of environmental management systems and quality assurance. | | | | | |
| Course content broken down in detail by weekly class schedule (syllabus) | 1st week: Introduction. Development and the environment. Important concepts. Contemporary issues in society. The objectives of environmental protection strategy with the aim of sustainable development.<br>2nd week: Linking industrial activity and social sciences and environmental sciences. Assessing the impact of chemical-technological processes on the environment. Origin and distribution of pollutants in air, soil and water, global warming and the greenhouse effect.<br>3rd week: The basics of sustainable development. The concept and evolution of sustainable development. Principles and models of sustainable development. | | | | | |

<table>
<tr><td></td><td colspan="6">Indicators of sustainable development, their management and implementation.<br>4th week: Preventive approach to cleaner production (non-waste production processes). Integrated Strategies for sustainable technologies and the development of the manufacturing process, products and support activities in order to increase production efficiency and environmental protection.<br>5th week: Analysis of resource flow in industrial ecosystems. Rational use of raw materials, water and energy and reduction of waste at source during the production. Examination (I colloquium).<br>6th week: "Cost-benefit" analysis in environmental protection as an indicator of proper environmental management strategy. Viewing and control of overall mass balance in industrial processes in environmental protection.<br>7th week: Environment and protection. From the rehabilitation and prevention of pollution to the environment management system. The implementation of environmental management systems and quality assurance. The role of ISO standards in environmental management strategy. Models for Environmental Management (ISO 14000 system). Models for Quality Assurance (ISO 9000).<br>8th week: Overview of all activities in the chemical production facility as the basis for a program of environmental management and quality assurance. Operational control and corrective measures.<br>9th week: A systematic monitoring of emissions to air, water and soil in industrial chemical processes. Sources of emissions of emissions, equipment and devices for different waste treatment processes. Selected examples.<br>10th week: Energy efficiency of the technology processes. Alternative energy (municipal waste, car tires, used oil and other waste materials).<br>11th week: Cement production - example of sustainable technology and development. Increased production efficiency and product quality.<br>12th week: European Union Directives (IPPC, WID, BATNEEC, BREF) for the prevention and control of pollution in the cement industry.<br>13th week: Methods of forecasting crisis situations and their prevention in production processes as the basis for the development of cleaner technologies.<br>14th week: The role of sustainable technologies in the development of new chemical-technological processes for the protection of heritage and ensure sustainable - sustainable, rather than survive development.<br>15th week: Examples of the application of the "cleaner" production concept on certain industrial processes. Best available technology (BAT) - principles, the implementation of sustainable and similar processes for the environment. Examination (II. Colloquium).</td></tr>
<tr><td>Format of instruction</td><td colspan="3">X lectures<br>X seminars and workshops<br>☐ exercises<br>X on line in entirety<br>☐ partial e-learning<br>☐field work</td><td colspan="3">X independent assignments<br>X multimedia<br>☐ laboratory<br>☐ work with mentor<br>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>0.5</td><td>Research</td><td>0</td><td>Practical training</td><td></td></tr>
<tr><td>Experimental work</td><td>0</td><td>Report</td><td>0</td><td>Exercises tests study (Other)</td><td></td></tr>
<tr><td>Essay</td><td>0</td><td>Seminar essay</td><td>1.0</td><td>Report from the exercises (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 | 1.0 | Project | 0 | (Other) | |
| Grading and evaluating student work in class and at the final exam | A student can pass the entire exam through tests (two tests) during the semester. Passing threshold is 55%. Students who did not pass the exam through tests pass the exam at regular examination dates and the exam consists of written and oral part. Limit of passing the written exam is 55%.<br><br>The principle of assessment: 55% -64% - sufficient, 65% -78% - good, 79% -90% - very good, 91% -100% - excellent. | | | | | |

| | Title | Number of copies in the library | Availability via other media |
|---|---|---|---|
| Required literature (available in the library and via other media) | T.E. Graedel, B.R.Allenby, Industrial Ecology and Sustainable Engineering, 1st Edition, Upper Saddle River, NJ, Prentice Hall, 2010. | 1 | |
| | M. L. Davis, D.A. Cornwell, Introduction to Environmental Engineering, 5th Edition, McGraw Hill, New York, 2013. | 1 | |
| | Z. Osmanović, J. Zelić, Production of Portland cement, Textbooks University of Tuzla, Tuzla (B&H), 2010. | 10 | |
| | | | |

| | |
|---|---|
| Optional literature (at the time of submission of study programme proposal) | European Union Directives:<br>• IPPC − Integrated Pollution Prevent and Control Directive<br>• WID − Waste Incineration Directive<br>• BATNEEC − Best Available Technology not Entailing Excesive Cost<br>• BREF − Best Available Technique Reference<br>• BAT − Best Available Technique for the Production of Cement. |
| Quality assurance methods that ensure the acquisition of exit competences | Quality and success will be monitored on three levels:<br>(1) University level, (2) faculty level and (3) teacher level. |
| Other (as the proposer wishes to add) | |

# Methods for Characterization of Materials

| NAME OF THE COURSE | Methods for characterization of materials | | |
|---|---|---|---|
| Code | KTC 112 | Year of study | 3. |
| Course teacher | Dražan Jozić,<br>Sanja Perinović Jozić | Credits (ECTS) | 5.0 |

| | | | | | | |
|---|---|---|---|---|---|---|
| Associate teachers | | Type of instruction (number of hours) | L | S | E | F |
| | | | 30 | | 30 | |
| Status of the course | Mandatory | Percentage of application of e-learning | | | | |

**COURSE DESCRIPTION**

| | | | |
|---|---|---|---|
| Course objectives | Acquisition of theoretical knowledge about different techniques and methods for characterization of materials, and practical knowledge about the preparation of samples and the application of simple and advanced instrumental techniques and 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 exam, student is expected to be able to:<br>• optimally use numerous possibilities of individual instruments<br>• conclude which instrumental technique and method can be applied to determine predicted properties of materials<br>• properly prepare samples and adjust a instrument for a particular measurement, i.e. to calibrate the instrument<br>• independently carry out measurements and determine basic parameters of the measured data | | |
| Course content broken down in detail by weekly class schedule (syllabus) | 1st week: | L | Introductory notes related to the course. Introduction to structure and properties of materials using MSE tetraedre (Material Science and Engineering) for clarification of relations between composition, structure, properties and synthesis of materials. Classification of materials. Classification based on structure of materials. Crystalline and amorphous state. Practical examples of structure and properties of waste materials in environment. |
| | | E | - |
| | 2nd week: | L | Development of techniques and methods for characterization of materials throughout the history. Introduction to methods for characterization of materials. The accuracy and precision of measurement, statistical deviation of measurement. Basic terminology in instrumental characterization of materials (calibration, recalibration, baseline, standards, systematic errors..). |
| | | E | - |
| | 3rd week: | L | Physical and chemical properties of materials. Basic notations and terminology. Crystal states. Symmetry elements. Crystal systems. Spatial symmetry and space groups. Crystal planes, Miller indices and interplane distances. d. Isomorphism and polymorphism. Enantiomorphism and chirality. Crystal habits. Dendrites. Composite crystals and splicings. Irregularities in crystals. |
| | | E | - |
| | 4th week: | L | Electromagnetic radiation. Instrumental methods and techniques. X-ray radiation. The interaction of X-ray radiation with electrons. The interaction of electromagnetic radiation with atoms. Basics of X-ray fluorescence techniques and methods. Calibration and calibration standards of instruments. Interpretation of the results. |
| | | E | Determination of the elemental composition using fluorescence techniques. |
| | 5th week: | L | Determination of the basic parameters of the diffraction pattern. |

| | | | |
|---|---|---|---|
| | | | Industrial constructions of instrument and performance limitations. |
| | | E | Rapid methods for characterization of materials using X-ray diffraction. |
| | 6th week: | L | Microscopic techniques. Light microscopy. The law of reflection. The law of refraction. Absolute and relative refractive index. Methods of measuring the refractive index. Birefringence. Construction of microscope. Polarizing microscope. Compensation plates and their role. |
| | | E | Application of microscopy in characterization of materials. |
| | 7th week: | L | Assessment of knowledge (I. test). Spectroscopic techniques and methods for characterization of materials. Theoretical background of infrared spectroscopy (IR). |
| | | E | Application of infrared spectroscopy in characterization of materials. |
| | 8th week: | L | Basics interactions of infrared radiation with a matter. Important terminology related to infrared spectroscopy and its possible application. Methods for a sample preparation. Methods and techniques of measurement. Practical guidelines for the measurement on infrared spectrometer. |
| | | E | Application of infrared spectroscopy in characterization of materials. |
| | 9st week: | L | Introduction to thermal techniques and methods. Fundamental terminology. Types of thermal techniques and methods. Factors affecting the results of thermal analysis. |
| | | E | - |
| | 10th week: | L | Theoretical background of thermogravimetry (TG). Standards for calibration and calibration methods of thermogravimeter and thermogravimeter / differential thermal analyzer (TG/DTA). Determination of the baseline and measurement interpretation. Importance of instrument calibration, measurement program, working conditions, preparation of samples. Interpretation of thermogravimetric curves. Possible applications of thermogravimetry (examples). Mistakes that occur in measurement. |
| | | E | Determination of thermal and thermo-oxidative stability of materials with thermogravimetric method. |
| | 11th week: | L | Assessment of knowledge (II. test). Theoretical background of differential scanning calorimetry (DSC) and differential thermal analysis (DTA). Instrumental designs of these techniques. |
| | | E | - |
| | 12th week: | L | Importance of instrument calibration, measurement program, working conditions, preparation of samples for differential scanning calorimetry and differential thermal analysis. Standards for calibration and recalibration of instruments. Determination of a baseline and measurement interpretation. Possible applications (examples) and possible problems. Mistakes that occur in the measurement. |
| | | E | Determination of thermal properties of material using differential scanning calorimetry. |
| | 13th week: | L | Theoretical background of thermomechanical (TMA) analysis and dynamic mechanical analysis (DMA). Construction of thermomechanical system. Calibration of the instrument, measurement program, working conditions, sample preparation, etc. Thermomechanical curves. Possible applications (examples) and possible problems. |
| | | E | - |

| | | | |
|---|---|---|---|
| | 14th week: | L | Construction of dynamic mechanical system (DMA). Calibration of the instrument, measurement program, working conditions, sample preparation, etc. Dynamic mechanical curves. Possible applications (examples) and possible problems. |
| | | E | - |
| | 15th week: | L | Repetition of course content. Assessment of knowledge (III. test). |
| | | E | - |

| | | |
|---|---|---|
| Format of instruction | x lectures<br>☐ seminars and workshops<br>x exercises<br>☐ *on line* in entirety<br>☐ partial e-learning<br>☐ field work | ☐ independent assignments<br>x multimedia<br>x laboratory<br>☐ work with mentor<br>☐(other) |
| Student responsibilities | Class attendance in the amount of 70% to 100%, and to experimental work of 100% from total hours. | |

| 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 | 1.0 | Research | | Practical training | |
| | Experimental work | 1.0 | Report | 0.5 | Exercises tests study (Other) | 0.6 |
| | Essay | | Seminar essay | | Report from the exercises (Other) | 0.5 |
| | Tests | 0.8 | Oral exam | 0.8 | (Other) | |
| | Written exam | 0.8 | Project | | (Other) | |

| | |
|---|---|
| Grading and evaluating student work in class and at the final exam | The entire exam can be passed over three tests during the semester. Minimum for successfully passed tests is limit of 50% of resolved test. Each test participates with a share of 25% in total grade. Class attendance in the amount of 70% to 100% presents the share of 5% in total grade, while the implementation of experimental work of 100% presents the share of 10% in total grade. During the regular examination period students pass the exam over a written and oral exam. Minimum for passage is 50% of resolved test. Each previously passed test (previous activity) is valid only in the summer examination period with a share of 10% in total grade. The written exam participates with 35%, while the oral exam participates with a share of 40% in total grade. Students who didn't pass the tests during the semester will take the exam during the regular examination period through the written and oral exam. Limit for passage is 50% of resolved test, the written and the oral part of the exam participates with a share of 50%.<br>Grading: 50%-61% - sufficient, 62%-74% - good, 75%-87% very good, 88%-100% - excellent. |

| Required literature (available in the library and via other media) | **Title** | **Number of copies in the library** | **Availability via other media** |
|---|---|---|---|
| | 1. H. Günzler and H. Gremlich, *Uvod u infracrvenu spektroskopiju*, Školska knjiga Zagreb, 2006. | 1 | |
| | 2. T. Kovačić, *Struktura i svojstva polimera*, Sveučilište u Splitu, Split, 2010. | 1 | |
| | 3. Michael E. Brown, *Introduction to Thermal Analysis, Techniques and Applications (2nd edition)*, Kluwer Academics Publishers, New York, 2004. | 1 | |
| | 4. B.E. Warren, *X-Ray diffraction*, Dover Publications, New York, 1990. | 1 | |

| | |
|---|---|
| Optional literature (at the time of submission of study programme proposal) | 1. Roger N. Clark, *Spectroscopy of Rocks and Minerals, and Principles of Spectroscopy*, John Wiley and Sons, Inc, New York, 1999.<br>2. Selected articles from journals recommended by lecturer |
| Quality assurance methods that ensure the acquisition of exit competences | Quality and success will be monitored on three levels:<br>(1) University level, (2) faculty level and (3) teacher level. |
| Other (as the proposer wishes to add) | |

# Environmental Remediation Technologies

| **NAME OF THE COURSE** | **Environmental remediation technologies** | | | | | |
|---|---|---|---|---|---|---|
| Code | KTC 113 | Year of study | 1 | | | |
| Course teacher | PhD Nediljka Vukojević Medvidović, associate professor<br>PhD Marina Trgo, full professor | Credits (ECTS) | 5.0 | | | |
| Associate teachers | - | Type of instruction (number of hours) | P | S | V | T |
| | | | 30 | 15 | 15 | |
| Status of the course | mandatory | Percentage of application of e-learning | - | | | |
| **COURSE DESCRIPTION** | | | | | | |
| Course objectives | Training students for independent and team work in identifying the specific locations of contamination in the environment, and the selection and application of methods of remediation. | | | | | |
| Course enrolment requirements and entry competences required for the course | | | | | | |
| Learning outcomes expected at the level of the course (4 to 10 learning outcomes) | It is expected that the outcome of learning to provide knowledge about:<br>- methods of identifying contaminated sites in the environment<br>- determining the type of contaminants and contamination intensity<br>- the selection procedures for remediation of environmental<br>- application of methods of remediation. | | | | | |
| Course content broken down in detail by weekly class schedule (syllabus) | 1st week: Assessing the state of the environment. Methods for identification and testing of contaminated sites in the environment.<br>2nd week: Types of pollutants. Qualitative and quantitative identification of contaminant in the contaminated site.<br>3rd week: Factors influencing migration (spreading) of contaminants in the environment. The role of soil and sediment in retaining and slowing ground water contamination.<br>4th week: Models of migration of contaminants in the environment.<br>5th week: Environmental remediation techniques: in situ, on site, ex situ. Selection criteria for remediation technologies.<br>6th week: Technologies for remediation of soil. Physical remediation: soil | | | | | |

| | |
|---|---|
| | encapsulation. Excavation of the soil. Mixing of soil.<br>7th week: Chemical soil remediation: electrochemical remediation, flooding, flushing, solidification / stabilization, natural cleaning.<br>8th week: Thermal soil remediation: incineration, vitrification, solar / photochemical degradation of the soil.<br>9th week: Biological soil remediation: bioremediation, bioventilation, phytoremediation, phytoextraction / phytoaccumulation.<br>10th week: Remediation of sediment<br>11th week: Remediation of groundwater. Ex situ physical / chemical processes: stripping, adsorption, oxidation, separation.<br>12th week: Remediation of groundwater. In situ physical / chemical processes: ventilation, stripping, permeable reactive barriers, oxidation.<br>13th week: Bioremediation of groundwater. Passive bioremediation. Biostimulation / Bioaugmentation.<br>14th week: Phytoremediation. Rhizosphere biodegradation. Fitodegradation.<br>15th week: Phytostabilization. Rhizofiltration. Phytovolatilization.<br>Seminar: Analysis of examples of remediation of contaminated sites in our country and in the world.<br>Exercises: Identification of contaminated environment and selection of the appropriate remediation techniques. Remediation of contaminated groundwater by using permeable reactive barriers. Calculation of distribution coefficient. Prediction of migration distribution of harmful substances in the environment. The use of flotation in the remediation of contaminated sediment. The application of dewatering in the remediation of the environment. Efficiency of dewatering of contaminated sediment and purity of the filtrate. Electroremediation of sediment polluted with heavy metals. Phytoremediation. |
| Format of instruction | **x** lectures<br>**x** seminars and workshops<br>**x** exercises<br>□*on line* in entirety<br>□partial e-learning<br>☐field work<br>□independent assignments<br>**x** multimedia<br>**x** laboratory<br>□work with mentor<br>□ (other) |
| Student responsibilities | Attending lectures is 80%, while seminars, laboratory exercises 100% of the total hours. |

| 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 | 1.0 | Research | | Practical training | |
| | Experimental work | 1.0 | Report | 0.5 | (Other) | |
| | Essay | | Seminar essay | 0.5 | (Other) | |
| | Tests | 0.5 | Oral exam | 0.5 | (Other) | |
| | Written exam | 1.0 | Project | | (Other) | |

| | |
|---|---|
| Grading and evaluating student work in class and at the final exam | Every laboratory exercises include oral exam before exercise and writing of final report.<br>The entire exam can be applied over the three written evaluation and one oral evaluation of seminar during the semester. Passing threshold is 60%. Students who have not passed evaluation during the semester should attend at the final exam in the regular examination period. Final exam will include written and oral exam. Passing threshold is also 60%. Rating: 60% -70% - satisfactory, 70% -80% - good, 80% -90% very good, 90% -100% - excellent. |

| Required literature | **Title** | **Number of** | **Availability via** |
|---|---|---|---|

| | | | |
|---|---|---|---|
| (available in the library and via other media) | | **copies in the library** | **other media** |
| | Krešić, N., Vujasinović, S., Matić, I. Remedijacija podzemnih voda i geosredine, Univerzitet u Beogradu, Beograd, 2006. | 1 | |
| | Kisić, I., Sanacija onečišćenoga tla, Zagreb: Agronomski fakultet Sveučilišta u Zagrebu, 2012. | 1 | |
| | L.H.Odell, Treatment technologies for groundwater, American Water Works Association, Denver, 2010. | | pdf |
| | N. L. Nemerow, F.J. Agardy, P. Sullivan, J.A. Salvato, Environmental Engineering, Soil and groundwater tretament and remediation, Sixth Edition, John Wiley & Sons, Inc.New Jersey, 2009. | | pdf |
| | S. Zrnčević, Čišćenje (remedijacija) podzemnih voda zagađenih organskim spojevima, Hrvatske vode 14 (2006) 305-310. | 1 | pdf |
| | S. Zrnčenić, Čišćenje (remedijacija) podzemnih voda zagađenih organskim spojevima - Fizikalno-kemijski "ex situ" postupci, Hrvatske vode 15 (2007) 17-24. | 1 | pdf |
| | S. Zrnčević, Čišćenje (remedijacija) podzemnih voda zagađenih organskim spojevima - Bioremedijacija "in situ", Hrvatske vode 15 (2007) 73-82. | 1 | pdf |
| | | | |
| | | | |
| Optional literature (at the time of submission of study programme proposal) | Scientific and professional paper | | |
| Quality assurance methods that ensure the acquisition of exit competences | Quality assurance will be performed at three levels:<br>(1) University Level; (2) Faculty Level by Quality Control Committee; (3) Lecturer's Level | | |
| Other (as the proposer wishes to add) | Suggestions and reactions of participants during the semester.<br>Student survey. | | |

# Advanced water treatment engineering

| **NAME OF THE COURSE** | **Advanced water treatment engineering** | | | | | |
|---|---|---|---|---|---|---|
| Code | KTC 201 | Year of study | 3 | | | |
| Course teacher | PhD Nediljka Vukojević Medvidović, associate professor | Credits (ECTS) | 7.0 | | | |
| Associate teachers | - | Type of instruction (number of hours) | P | S | V | T |
| | | | 30 | 15 | 30 | |
| Status of the course | mandatory | Percentage of application of e-learning | - | | | |
| **COURSE DESCRIPTION** | | | | | | |

| | |
|---|---|
| Course objectives | Knowledge of advanced water treatment processes for high standards of effluent quality and natural purification processes in rural areas. |
| Course enrolment requirements and entry competences required for the course | Passed a subject dealt with classical processes of water treatment (Wastewater treatment and / or Industry and Environment) |
| Learning outcomes expected at the level of the course (4 to 10 learning outcomes) | It is expected that the outcome of learning to provide knowledge about:<br>-the necessity of the development and application of advanced water treatment processes, with special emphasis on the protection of vulnerable karst aquifer<br>- types of process, application and advantages of the application of advanced process compared to conventional treatment processes<br>- analysis of the ecological footprint water treatment facilities<br>- advanced oxidation technologies in water treatment<br>- chemical reactions and reaction mechanisms of hydroxyl radicals<br>- mechanism, kinetics and the performance of the adsorption and ion exchange in water treatment<br>- biological processes of removing nitrogen and phosphorus, technological performances, removal efficiency<br>- the application of MBR technology in water treatment and comparison of membrane bioreactor technology with other technologies for biological treatment of wastewater |
| Course content broken down in detail by weekly class schedule (syllabus) | 1st week: Introduction lecture: Preserving the quality of natural water. Recycling and reuse of water.<br>2nd week: Advanced processes of water treatment. Overview of processing methods. Analysis of the ecological footprint of water treatment facilities. Seminar.<br>3rd week: Advanced Oxidation Processes. Theoretical basis. The formation of hydroxyl radicals and their role.<br>4th week: Reaction mechanisms and kinetics of production of reactive hydroxyl radicals in systems: $H_2O_2$ / UV, $Fe^{3+}$ / UV, $Fe^{3+}$ / $H_2O_2$ / UV, $Fe^{2+}$ / $H_2O_2$, $Fe^{3+}$ / $H_2O_2$.<br>5th week: The factors influencing on the process of oxidation. Practical application of advanced oxidation processes. The possibilities and limitations. Seminar.<br>6th week: The use of adsorption to remove residual organic compounds. The factors influencing on the adsorption. Batch and column performance. Advantages and disadvantages.<br>7th week: Mathematical models of the adsorption column. Models based on mass transfer. Seminar.<br>8th week: The biological nitrogen removal processes. Nitrification and denitrification. Technological process implementation. Seminar.<br>9th week: Biological phosphorus removal processes. Technological performance. The efficiency of phosphorus removal. Seminar.<br>10th week: Combined biological removal of nitrogen and phosphorus. Designing process. Seminar.<br>11th week: Removal of dissolved inorganic substances by ion exchange. The mechanism and kinetics of the process.<br>12th week: Designing of cation and anion exchanger. Seminar.<br>13th week: The advanced membrane processes for water treatment. Methods review. Influential factors. Membrane bioreactor-MBR technology. Performance. Efficiency. Seminar.<br>14th week: The natural processes of water treatment. Mechanism. Performance. |

| | |
|---|---|
| | Advantages and disadvantages compared to conventional water treatment processes. Seminar.<br>15th week: An integrated approach to solving the problem of water treatment. Case study. Seminar.<br><br>Exercises: The efficiency of removal of organic matter by using $Fe^{2+}$ / $H_2O_2$ process. Removal of colorants by adsorption on activated carbon. Determination of the operating capacity of activated carbon. Removal of dissolved inorganic ion by ion exchange in the column. Calculation of characteristic parameters of the breakthrough curve. Analysis of biodegradation of waste water. The kinetics of biological degradation of organic substances with high content of nitrogen. The efficiency of plant equipment. |

| | | |
|---|---|---|
| Format of instruction | **x** lectures<br>**x** seminars and workshops<br>**x** exercises<br>☐*on line* in entirety<br>☐partial e-learning<br>☐field work | **x** independent assignments<br>**x** multimedia<br>**x** laboratory<br>☐work with mentor<br>☐ (other) |
| Student responsibilities | Attending lectures is 80%, while seminars, laboratory exercises 100% of the total hours. | |

| 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 | 1.5 | Report | 0.5 | (Other) | |
| | Essay | | Seminar essay | 1.0 | (Other) | |
| | Tests | 0.5 | Oral exam | 1.0 | (Other) | |
| | Written exam | 1.0 | Project | | (Other) | |

| | |
|---|---|
| Grading and evaluating student work in class and at the final exam | Every laboratory exercises include oral exam before exercise and writing of final report.<br>The entire exam can be applied over the three written evaluation. Passing threshold is 60%. Students who have not passed evaluation during the semester should attend at the final exam in the regular examination period. Final exam will include written and oral exam. Passing threshold is also 60%. Rating: 60% -70% - satisfactory, 70% -80% - good, 80% -90% very good, 90% -100% - excellent. |

| Required literature (available in the library and via other media) | **Title** | **Number of copies in the library** | **Availability via other media** |
|---|---|---|---|
| | T. Matsuo, K. Hanaki, S. Takizawa, H. Satoh (eds.), Advances in Water and Wastewater Treatment Technology, Elsevier, London-Amsterdam, 2001. | - | pdf |
| | N. P. Cherrmisinoff, Handbook of water and wastewater treatment technology, Butterwort-Heinemann, Boston, 2002. | - | pdf |
| | J. M. Coulson, J.F. Richardson, Chemical engineering, 5th edition, Butterworth-Heinemann, Oxford, 2002. | 1 | pdf |
| | R.W. Baker, Membrane technology and application, Second Edition, John Wiley & Sons, Ltd, Hoboken (USA), 2004. | - | pdf |
| | David W. Hendricks, Water Treatment Unit Processes, Physical and Chemical, CRC Press, | 1 | |

| | | | |
|---|---|---|---|
| | Taylor & Francis Group, Boca Raton, 2006. | | |
| | D. Malus, D. Vouk, Priručnik za učinkovitu primjenu biljnih uređaja za pročišćavanje sanitarnih otpadnih voda, Sveučilište u zagrebu, Građevinski fakultet, 2012. | - | pdf |
| | N. Koprivanac, H. Kušić, Hazardous organic pollutants in colored wastewater, Nova Science Publishers, Inc., New York, 2009. | - | pdf |
| | Judd, S., The MBR book, Elsevier Ltd., Oxford, UK, 2006. | | pdf |
| | Henze, M., van Loosdrecht, M.C.M., Ekama, G., Brdjanovic, D. Biological Wastewater treatment, IWA Publishing, 2008, London, UK | - | pdf |
| | | | |
| | | | |
| | | | |
| Optional literature (at the time of submission of study programme proposal) | D. Mara, Domestic wastewater treatment in developing country, Earthscan, London, UK, 2004.<br>M. von Sperling, Basic principle of wastewater treatment, IWA Publishing, London, 2007. | | |
| Quality assurance methods that ensure the acquisition of exit competences | Quality assurance will be performed at three levels:<br>(1) University Level; (2) Faculty Level by Quality Control Committee; (3) Lecturer's Level | | |
| Other (as the proposer wishes to add) | Suggestions and reactions of participants during the semester.<br>Student survey. | | |

# Solid Waste Recycling

| **NAME OF THE COURSE** | **SOLID WASTE RECYCLING** | | | | | |
|---|---|---|---|---|---|---|
| Code | KTC 219 | Year of study | 2. | | | |
| Course teacher | Ph.D. Ivana Smoljko, assistant professor | Credits (ECTS) | 3.0 | | | |
| Associate teachers | | Type of instruction (number of hours) | P | S | V | T |
| | | | 30 | 0 | 0 | 0 |
| Status of the course | Mandatory | Percentage of application of e-learning | | | | |
| **COURSE DESCRIPTION** | | | | | | |
| Course objectives | The course will provide multidisciplinary knowledge regarding all aspects of municipal and industrial solid waste recycling technology, such as project management, energy efficiency and economy, quality assurance, environmental protection, safety and health, and legal aspects and their effect on technological choices. | | | | | |
| Course enrolment requirements and entry competences required for the | | | | | | |

<table>
<tr><td>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">By the end of this course, students will be able to:<br>- identify key sources, typical quantities generated, composition, and properties of solid waste;<br>- describe and explain recovery and recycling techniques and their impacts;<br>- identify and quantitatively assess recycling technologies according to the characteristics of the materials to be recovered;<br>- analyse quantitative and qualitative problems associated with operation of recycling techniques;<br>- estimate solid waste recycling costs.</td></tr>
<tr><td>Course content broken down in detail by weekly class schedule (syllabus)</td><td colspan="6">1st week: Introduction. Definition of solid waste (physical, chemical and biological characteristics of solid wastes). Technological, economic, environmental and social aspects of recycling.<br>2nd week: Recyclability criteria. Ecodesign.<br>3rd week: Characterisation of waste streams, recycling and solid waste characterisation.<br>4th week: Recycling of complex multimaterial consumer goods (cars, electronics, etc.).<br>5th week: Recycling Technologies: paper.<br>6th week: Recycling Technologies: glass.<br>7th week: First test.<br>8th week: Recycling Technologies: ferrous metals.<br>9th week: Recycling Technologies: non-ferrous metals.<br>10th week: Recycling Technologies: composite materials.<br>11th week: Recycling Technologies: bio-waste.<br>12th week: Recycling Technologies: textiles and carpets.<br>13th week: The economics of recycling.<br>14th week: Trends in solid waste recycling: issues, challenges and opportunities.<br>15th week: Second test.</td></tr>
<tr><td>Format of instruction</td><td colspan="3">☒ lectures<br>☐seminars and workshops<br>☐exercises<br>☐ on line in entirety<br>☐ partial e-learning<br>☐field work</td><td colspan="3">☒ independent assignments<br>☒ multimedia<br>☐ laboratory<br>☐ work with mentor<br>☐ (other)</td></tr>
<tr><td>Student responsibilities</td><td colspan="6">Lecture attendance: 80 %.</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>0</td><td>Practical training</td><td>0</td></tr>
<tr><td>Experimental work</td><td>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>0.5</td><td>Oral exam</td><td>1</td><td>(Other)</td><td></td></tr>
<tr><td>Written exam</td><td>0.5</td><td>Project</td><td>0</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. Examination passing rate is 55%. Students who do not pass the partial exams have to take an exam in the regular examination periods. The exam consists of two parts: written and oral. Written part will constitute 40% and oral part will</td></tr>
</table>

| | | | |
|---|---|---|---|
| | constitute 60% of the final score.<br>Grades with numerical equivalents: <55% insufficient – fail (1); 55%-65% - sufficient (2); 66% -77% - good (3); 78% -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** |
| | E. Worrell, M. A. Reuter, Handbook of Recycling: State-of-the-art for Practitioners, Analysts, and Scientists, Elsevier Inc., United Stated of America, 2014. | 1 | |
| | H. Lund, McGraw-Hill Recycling Handbook, 2nd Edition Hardcover, The McGraw-Hill Companies, Inc., United Stated of America, 2001. | 1 | |
| | M. Kljajin, M. Opalić, A. Pintarić: Recikliranje električnih i elektroničkih proizvoda, Sveučilište J. J. Strossmayer u Osijeku i Sveučilište u Zagrebu, 2006. | 1 | |
| Optional literature (at the time of submission of study programme proposal) | - A. Pintarić, T. Filetin: Analiza recikličnosti proizvoda, Zbornik III. među. simpozija "Gospodarenje otpadom Zagreb 94", Zagreb, 1994, str. 59-68.<br>- Professional Journals. Scientific Journals (Industry and Environment-UNEP ). | | |
| Quality assurance methods that ensure the acquisition of exit competences | Quality assurance will be performed at three levels:<br>(1) University Level;<br>(2) Faculty Level by Quality Control Committee;<br>(3) Lecturer's Level. | | |
| Other (as the proposer wishes to add) | | | |

# Microbiology of Polluted Waters

| **NAME OF THE COURSE** | **Microbiology of Polluted Waters** | | | | | |
|---|---|---|---|---|---|---|
| **Code** | KTC206 | Year of study | 2nd | | | |
| Course teacher | PhD, Nada Krstulović, prof. | Credits (ECTS) | 5.0 | | | |
| Associate teachers | | Type of instruction (number of hours) | L | S | E | F |
| | | | 30 | 15 | 15 | |
| Status of the course | Elective | Percentage of application of e-learning | 20 | | | |
| **COURSE DESCRIPTION** | | | | | | |
| Course objectives | The purpose oft his course is to provide an introduction to microbial water pollution, especially to microorganisms which are actual or potential water-borne human pathogens. | | | | | |
| Course enrolment requirements and entry competences required for the course | Knowledge in Basic Microbiology | | | | | |

| | |
|---|---|
| Learning outcomes expected at the level of the course (4 to 10 learning outcomes) | • Acquisition of knowledge about the sources of microbial contamination of natural waters.<br>• Acquisition of knowledge about the microorganisms which are actual or potential water-borne human pathogens.<br>• Understanding of the definition of indicator organisms.<br>• Understanding the criteria and standards for assessing the quality of different types of water (drinking water, recreational water, acquaculture areas, etc.) .<br>• Acquisition of knowledge about the fate of allochthonous microorganisms upon arrival in the aquatic environment, or on their mechanisms of adaptation and survival.<br>• Introduction to environmental factors that affect the survival (T90) of indicators and pathogenic microorganisms in different types of water environment.<br>• Acquisition of knowledge about the impact of allochthonous microorganisms on organisms living in that aquatic environment.<br>• Understanding why shellfish are considered the most risk organisms in microbiologically polluted water, and what are the factors affecting the rate of concentration of microorganisms in shellfish.<br>• Acquisition of knowledge about the processes of eutrophication and conditions which cause toxic algal blooms and blooms of cyanobacteria. |
| Course content broken down in detail by weekly class schedule (syllabus) | Lesson 1. **Introduction to Sanitary Microbiology** (2 hours)<br>Microbiological contamination of waters as one of the main public health problems. Clasification of different types of water distinguished on the basis of use (drinking water, bathing waters, waters used for other recreational purposes, aquaculture areas).<br>Lesson 2. **Sources of microbiologica pollution** (2 hours)<br>Sources of microbial pollution: untreated wastewater discharges and outfalls, including type, e.g. industrial, domestic or mixed; Water pollutant sources can be grouped into two supercategories: (a) point sources which can be attributed to discrete discharge from a factory or sewage outfall and (b) non-point sources that include agricultural runoff, urban stormwater runoff and other area wide sources.<br>Lesson 3. **Rewiev of pathogens or potential human pathogens in polluted waters** (2 hours)<br>Microorganisms which are actual or potential pathogens of man and can be transmitted through polluted waters, or through consumption of contaminated waterfood: bacteria, viruses, fungi and variety of protozoan and metazoan parasites.<br>Lesson 4: **Pathogenic microorganisms** (3 hours)<br>The main features of cammon pathogenic bacteria in polluted waters: Salmonella,Shigella, Vibrio, Staphylococcus, Pseudomonas, Clostridium, Campylobacter, Yersinia, Aeromonas, enteropathpgenic *Escherichia coli*, and a number of streptococci. Viruses: various group pf viruses are known to be isolated from polluted waters, including enteroviruses, reoviruses, adenoviruses and parvoviruses. Pathogenic fungi: the most common one associated with infection through contact with polluted waters is Candida albicans. Features of other parasites.<br>Lesson 5. **Microbial indicator organisms** (2 hours)<br>Concept, definition and features of indicator organisms.The main parameters used for monitoring quality of waters are bacterial indicator organisms. The main ones are the following: total coliforms, faecal coliforms (*Escherichia coli*), faecal streptococci, intestinal enterococci, and some others regarding the use of monitored waters.<br>Lesson 6. **A water quality criteria and standards** (2hours) |

| | |
|---|---|
| | Concept and definition of microbial water quality criteria and standards. The concept of acceptability for various types of water (drinking water, fresh water environment, marine environment). Microbial water quality assesment.<br>Lesson 7. **Fate of allochthonous microorganisms after arrival in the aquatic environment** (2 hours)<br>Surviving of alochtonous microorganisms in the aquatic environment: Mechanisms of adaptation and survival of alochtonous microorganisms in the freshwater and marine environments.<br>Lesson 8. **Environmental factors influencing to die-off of microorganisms in water environments** (3 hours)<br>Factors that can affect die-off of microorganisms in water environments: temperature, solar radiation, salinity, osmotic preassure, pH, nutrients, simultaneous effect of environmental factors, antagonistic effect of other organisms.<br>Lesson 9. **Determination of survavial rates for selected bacteria** (2 hours)<br>T90 value of the indicator bacteria and some pathogens. The differential die-off of indicators in marine and fresh water environments.<br>Lesson 10. **The accumulation of microorganisms in organisms living in that environment** (2 sata)<br>Impact of allochtonous microorganisms on sanitary quality of organisms that live in that environment.<br>Lesson 11. **Overview of risk groups of edible organisms to human health** (2 hours)<br>Shellfish as the risk organisms for human health. Features of shellfish due to the sessile mode of life and feeding by filtering water. Review of factors that affect the filtration rate of shellfish and the rate of concentration of microorganisms in shellfish.<br>Lesson 12. **Infections and poisoning by shellfish** (2 hours)<br>The role of shellfish as vectors in human deseases. The most common pathogens transferable via shellfish.<br>Lesson 13. **Eutrophication and toxic phytoplankton blooms** (2 hours)<br>Blooms of toxic algal species producing potent toxins. Acumulation of biotoxins in shellfish during filter feeding becoming vectors in various forms of shellfish poisoning.<br>Lesson 14. **Blooms of Cyanobacteria** (2 hours)<br>Risk assessment of the mass proliferation of cyanobacteria. Cyanotoxins. Human health risk assessment related to Cyanotoxins.<br>**Seminars**<br>Students prepare seminars in topics related to the lessons and presentations of seminars are followed by discussion.<br><br>**Laboratory Exercises**<br>Exercise 1. (3 hours)<br>Sampling of water<br>Determination of microbiological quality of drinking water by spread plate technique.<br>Determination of indicators of faecal pollution in drinking water and seawater by membrane filtration culture method: E. coli, faecal coliforms and intestinal enterococci following ISO standards.<br><br>Exercise 2. (3 hours)<br>Determination of E. coli and faecal coliforms by MPN method following ISO standards.<br>Dtermination of intestinal enterococci in seawater by MPN method (after WHO/UNEP 1995)<br><br>Exercise 3. (4 hours)<br>Determination of indicators of faecal pollution int he shellfish:<br>Determination of E. coli int he shellfish by MPN method following ISO standards. |

| | |
|---|---|
| | Determination of E. coli and faecal coliforms in shellfish by MPN method following ISO standards<br>Dtermination of intestinal enterococci in sshellfish by MPN method (after WHO/UNEP 1995)<br><br>Exercise 4. (2 hours)<br>Determination of some pathogens in shellfish:<br>Dtermination of Salmonella in shellfish following ISO standards<br><br>Exercise 5. (3 hours)<br>Determination of sanitary quality of freshwater and marine sediments by pour plate technique (after WHO/UNEP 1995).<br>Dtermination of total number bacteria in water samples by fluorescence method.<br>Dtermination of total number bacteria in water samples by flow citometer method. |
| Format of instruction | x lectures<br>X seminars and workshops<br>x exercises<br>☐ *on line* in entirety<br>☐ partial e-learning<br>☐ field work<br>☐ independent assignments<br>x multimedia<br>x laboratory<br>☐ work with mentor<br>☐ (other) |
| Student responsibilities | Class attendance is mandatory , seminars, discussions on teaching units. |

| 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 | 1 | Research | | Practical training | |
| | Experimental work | | Report | | (Other) | |
| | Essay | | Seminar essay | 1 | (Other) | |
| | Tests | 2 | Oral exam | 1 | (Other) | |
| | Written exam | | Project | | (Other) | |

| | |
|---|---|
| Grading and evaluating student work in class and at the final exam | 90-100% of the resolved questions in tests and oral exam- excellent (5)<br>80-89% of the resolved questions in tests and oral exam -very good (4)<br>70-79% of the resolved questions in tests and oral exam - good (3)<br>60-69% of the resolved questions in tests and oral exam - sufficient (2)<br><60% - student is not satisfied |

| Required literature (available in the library and via other media) | **Title** | **Number of copies in the library** | **Availability via other media** |
|---|---|---|---|
| | Krstulović, N: Power Point teaching lessons at CD. | All students receive CD | |
| | Krstulović, N. I M. Šolić, 2006. Alohtoni mikroorganizmi u moru, 199-254. U: Mikrobiologija mora, IOR-Split, 317p. Udžbenik Sveučilišta u Splitu. | 10 | |
| | Selected articles from scientific publications | | |
| | | | |

| | |
|---|---|
| Optional literature (at the time of submission of study programme proposal) | Laws, E.A. (2000). Aquatic Pollution, An Introductory Text (Third Edition). Willey Intersci. Publ., New York, 672 pages.<br>T.N. Hofer, (2008).Marine pollution: New Research, Nova Science Publishers, New York, 448p. |
| Quality assurance methods that ensure the acquisition of exit | Through questioners of the Universities of Split |

| | |
|---|---|
| competences | |
| Other (as the proposer wishes to add) | |

# Ecotoxicology

| NAME OF THE COURSE | Ecotoxicology | | | | | |
|---|---|---|---|---|---|---|
| **Code** | KTC211 | Year of study | 2nd | | | |
| Course teacher | PhD, Jasna Maršić Lučić, associate prof. | Credits (ECTS) | 5.0 | | | |
| Associate teachers | | Type of instruction (number of hours) | L | S | E | F |
| | | | 30 | | 15 | |
| Status of the course | Elective | Percentage of application of e-learning | | | | |
| **COURSE DESCRIPTION** | | | | | | |
| Course objectives | Gaining of basic theoretical and practical knowledge of direct and indirect effects of xenobiotics on the environment, at all living organisms, and their relationship to inanimate matter. | | | | | |
| 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 finishing this course the student is expected to know:<br>- basic concepts and relationships in the ecosystem,<br>- types of pollution and ways which are due to the environment<br>- the mechanisms of action of different types of xenobiotics,<br>- molecular-cellular aspects of toxicity,<br>- the role of bioindicators and biomarkers for determining the condition of environmental pollution in land and water ecosystems . | | | | | |
| Course content broken down in detail by weekly class schedule (syllabus) | 1st week: Introduction to ecotoxicology. Definitions of terms and development of ecotoxicology.<br>2nd week: Human impact on the environment. The division of pollutants per site pollution .Persistence and detoxication.<br>3thweek: Physiological classification of pollutants. Factors that determine the movement and distribution of pollutants<br>4thweek: The pathophysiological effects of poisoning. The mode of action of pollutants. Absorption and distribution of xenobiotics in the body<br>5th week: Molecular-cellular aspects of toxicity.Transport of toxicants through the cell membrane<br>6th week: Biotransformation. Biodynamics and excretion of toxic substances.<br>7th week: Biological degradation of the toxic substances in the environment. Transport mechanisms in the environment.Bioaccumulation, bioconcentration and biomagnification<br>8th week: Assessment of genotoxicity.UV radiation and marine phytoplankton<br>9th week: Introduction to analytical methods in ecotoxicology. Qualitative analytical methods for determination of toxicants<br>10th week: Quantitative analytical methods for the determination of toxicants<br>11thweek: The mechanism of toxicity and detection of nitrate, nitrite and ammonia<br>12th week: Methods for detection of cyanide and cyanide glycoside<br>13th week: The mechanism of toxicity of heavy metals<br>14th week: Methods of biomonitoring, analysis of residues (determining MRL).<br>15th week: Biological determination of toxins from shellfish | | | | | |

| | | |
|---|---|---|
| Format of instruction | ☒ lectures<br>☐ seminars and workshops<br>☒ exercises<br>☐ *on line* in entirety<br>☐ partial e-learning<br>☐ field work | ☐ independent assignments<br>☐ multimedia<br>☐ laboratory<br>☐ work with mentor<br>☐ (other) |
| Student responsibilities | | |

| 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 | 1.5 | Research | | Practical training | 1.5 |
| | Experimental work | | Report | | (Other) | |
| | Essay | | Seminar essay | | (Other) | |
| | Tests | 0.8 | Oral exam | 0.6 | (Other) | |
| | Written exam | 0.6 | Project | | (Other) | |

| | |
|---|---|
| Grading and evaluating student work in class and at the final exam | Students' work will be evaluated and assessed during the teaching process as well as on the final exam.<br>Overall examination can be applied over the two exams during the semester. Passing threshold is 60%. Each exams is scored and gets a score that enters the final assessment of the case. In the exam period there is a written and oral exam, Rating: 60% -70% - sufficient, 71% -80% - good, 81% -90% -very good, 91% -100% - excellent. |

| Required literature (available in the library and via other media) | **Title** | **Number of copies in the library** | **Availability via other media** |
|---|---|---|---|
| | Springer, O., Springer, D. Otrovani modrozeleni planet, Meridijani, Samobor, 2008. | 1 | Institute of oceanography and fisheries-library |
| | J. Maršić Lučić, Ecotoxicology, lectures in english, ppt | 1 | Institute of oceanography and fisheries-web |
| | Srebočan V. Veterinarska toksikologija, Medicinska naklada, 1993. | 1 | Institute of oceanography and fisheries-library |
| | Hoffman, D.J., Rattner,B.A., Burton, G.A.jr. , Cairns, J.,jr. 1995. Handbook of ecotoxicology, CRC Press, | 1 | Institute of oceanography and fisheries-library |
| | | | |
| | | | |
| | | | |
| | | | |

| | |
|---|---|
| Optional literature (at the time of submission of study programme proposal) | Walker,C.H., Hopkin, S.P., Sibly, R.M.and Peakall,D.B.: Principles of ecotoxicology Taylor & Francis publ. 1997.<br>Kamrin, M.A.: Toxicology : a primer on toxicology principles and applications. Lewis publishers. 1988 |

| | |
|---|---|
| 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) | |

# Soil Chemistry

| **NAME OF THE COURSE** | **Soil Chemistry** | | | | | |
|---|---|---|---|---|---|---|
| Code | KTC212 | Year of study | 2nd | | | |
| Course teacher | PhD, Maša Buljac, assistant prof. | Credits (ECTS) | 5.0 | | | |
| Associate teachers | | Type of instruction (number of hours) | L | S | E | F |
| | | | 30 | 15 | 15 | |
| Status of the course | Elective | 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 :<br>□ Identify chemical composition pedosphere, the origin of the chemical constituents in the soil<br>□ To compare the natural and anthropogenic processes caused by the transformation of mineral and organic matter in soil<br>□ Establish similarities and differences in the chemical processes in different soils<br>□ The sources of soil contamination as a result of human activity<br>□ Make a plan of chemical analyzes for different needs<br>□ 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<br>**Lecture 2:** The fundamental substrates and processes of pedogenesis<br>**Lecture 3:** Mineral soil structure (oxides and hydroxides of Al, Si, Fe, Mn, no silicate minerals, secondary clay minerals, ion dispersion)<br>**Seminar 1 (2 hours):** Redox reactions of cations and anions at the solid-liquid<br>**Lab course 1** (**3 hours**): Soil analysis (determining the acidity of the soil, the determination of total carbonate in the soil).<br>**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).<br>**Lecture 5:** The liquid phase of the soil. The properties of the soil solution. | | | | | |

<table>
<tr><td></td><td colspan="6">Seminar 2 (2 hours):. soil acidity, soil pH<br>Lab course 2 (3 hours): Determination of buffering capacity of the soil.<br>Lecture 6: The processes of precipitation and dissolution<br>Lecture 7: I. Partial Test<br>Seminar 3 (2 hours): Methods of measuring soil acidity<br>Lab course 3 (3 hours): Determination of ammonium nitrogen in the soil with Nessler reagent.<br>Lecture 8: Reactions of cations and anions at the interface soil-solution<br>Lecture 9: The acidity of the soil, methods of measuring soil acidity, soil acidity and origin correction of soil acidity.<br>Seminar 4 (2 hours): The redox potential of the soil and the practical application<br>Lab course 4 (3 hours): Determination of physiologically active lime (CaO%) by the method of Galeta.<br>Lecture 10: Alkalinity, salinity, soil buffers. Soil contamination from organic and inorganic compounds<br>Lecture 11:: The basic principles of electrochemistry.<br>Seminar 5 (2 hours): The chemical composition of the organic portion of soil.<br>Lab course 5 (3 hours ): Determination of total nitrogen in plant material and soil by the method of Kjeldahl.<br>Lecture 12: The redox potential of the soil and practical application.<br>Lecture 13: The properties of colloids in the environment.<br>Seminar 6 (2 hours): The liquid phase of the soil<br>Lecture 14: The problems of soil contamination.<br>Lecture 15: II. partial test<br>Seminar 4 (2 hours ): oxido-reducing conditions in the soil</td></tr>
<tr><td>Format of instruction</td><td colspan="3">×lectures<br>×seminars and workshops<br>×exercises<br>□on linein entirety<br>□partial e-learning<br>□field work</td><td colspan="3">□independent assignments<br>□multimedia<br>×laboratory<br>□work with mentor<br>□ (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>0.8</td><td>Research</td><td></td><td>Practical training</td><td>0.2</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></td><td>(Other)</td><td></td></tr>
<tr><td>Tests</td><td>1.0</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 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="2">Required literature (available in the library and via other media)</td><td colspan="4">Title</td><td>Number of copies in the library</td><td>Availability via other media</td></tr>
<tr><td colspan="4">D.L. Sparks, Environmental Soil Chemistry, 2 nd edition Academic Press,</td><td></td><td></td></tr>
</table>

| | | | |
|---|---|---|---|
| | London, 2003.<br>M. Cresser, K. Killham, T. Edwards, Soil Chemistry and its applications, Cambridge University Press, Cambridge, 1993.;<br>A. Škorić, Postanak, razvoj i sistematika tala, Sveučilište u Zagrebu, 1986<br>A. Škorić, Sastav i svojstva tla, Fakultet poljoprivrednih znanosti, Zagreb, 1991. | | One copy in the 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;<br>A. Škorić, Priručnik za pedološka istraživanja, Fakultet poljoprivrednih znanosti, Zagreb, 1982.;<br><br>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) | | | |

# Recycling of Plastics

| **NAME OF THE COURSE** | **Recycling of Plastics** | | | | | |
|---|---|---|---|---|---|---|
| Code | KTC215 | Year of study | 2nd | | | |
| Course teacher | PhD, Matko Erceg, associate 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 | - rising awareness and knowledge about the necessity of plastics recycling<br>- understanding of modern methods of plastic recycling<br>- implementation of the adopted basic knowledge in finding optimal solutions for recycling of plastics | | | | | |
| Course enrolment requirements and entry competences required for the course | None | | | | | |
| Learning outcomes expected at the level of the course (4 to 10 learning | After passing the exam, the student is expected to be able to:<br>- explain and argue the importance of plastics for sustainable development<br>- categorize the sources of plastic waste<br>- explain the importance of sorting plastic waste | | | | | |

<table>
<tr><td>outcomes)</td><td colspan="6">- propose and implement a procedure for sorting plastic waste<br>- explain the basic characteristics of the mechanical, chemical and energy recovery of plastics<br>- choose the optimal method of waste recovery given its composition</td></tr>
<tr><td>Course content broken down in detail by weekly class schedule (syllabus)</td><td colspan="6">1st week: Introduction. The nomenclature of the polymer. The classification of polymers. Polymerization (step-growth, chain). Methods of polymerization.<br>2nd week: The structure of the polymer: bonds, configurations and conformations of polymers. The physical state of the polymer-thermomechanical curves. Mechanisms of polymer degradation.<br>3rd week: Polymers and sustainable development. Life cycle stages of plastic. Additives for polymers. Ecological aspects of polymer additives (examples: heat stabilizers and plasticizers for poly(vinyl chloride)).<br>4th week: Polymer processing procedures (extrusion, injection molding). Environmental burden at the stage of processing of polymers.<br>5th week: World, European and Croatian plastics industry - statistical data. Types of plastic waste.<br>6th week: Plastics waste in household, automotive, construction, electric, electronic, agriculture and distribution. Recycling of plastic waste and sustainable development.<br>7th week: Material recovery (recycling). Homogeneous and heterogeneous plastic waste. The collection and identification of plastic waste.<br>8th week: Sorting of plastic waste: float-sink method, supercritical fluids method, air classification, hydrocyclon classification, optical sorting method, infrared spectroscopy method.<br>9th week: Sorting of plastic waste: X-ray fluorescence (XRF) method, electrostatic classification method, sorting by melting temperature, sorting by selective dissolution.<br>10th week: Reduction of plastic waste: granulators, mills, shredders, apparatus for agglomeration and compacting, mills (turbo mill, disks), cryogenic milling, shear extrusion in the solid state, chemical fragmentation.<br>11th week: Plants for recycling homogeneous and heterogeneous plastic waste.<br>12th week: Chemical recycling of plastic waste (examples, plants): depolymerization processes (hydrolysis, alcoholysis, glycolysis, acidolysis, aminolysis), thermolysis processes (gasification, pyrolysis, hydrogenation)<br>13th week: Energy recovery of plastic waste: burning on the mechanical stoker incinerator, incineration in rotary kilns, fluidized-bed combustion.<br>14th week: Waste disposal and landfill. Behavior of plastic waste in landfills. The management of plastic waste.<br>15th week: Life Cycle Assessment (LCA method). Conclusions.<br><br>Exercises: Manual sorting of packaging plastic waste, Sorting of plastic waste by float-sink method, Sorting of plastic waste using infrared spectroscopy, Separation of poly (vinyl chloride) and poly (ethylene terephthalate), Effect of repeated recycling of the thermal properties of polymers, Chemical recycling of poly (ethylene terephthalate) by glycolysis, Recycling of expanded polystyrene.</td></tr>
<tr><td>Format of instruction</td><td colspan="3">x lectures<br>□seminars and workshops<br>□exercises<br>□on linein entirety<br>□partial e-learning<br>□field work</td><td colspan="3">□independent assignments<br>x multimedia<br>x laboratory<br>□work with mentor<br>□ (other)</td></tr>
<tr><td>Student responsibilities</td><td colspan="6">Attending lectures in the 80% amount, and laboratory exercises in the 100% amount of the total number of lessons.</td></tr>
<tr><td rowspan="2">Screening student work(name the proportion of ECTS credits for each</td><td>Class attendance</td><td>1.0</td><td>Research</td><td></td><td>Practical training (analysis of data)</td><td>0.2</td></tr>
<tr><td>Experimental work</td><td>1.0</td><td>Report</td><td>0.2</td><td>Preparation for exp. work</td><td>0.4</td></tr>
</table>

| | | | | | | |
|---|---|---|---|---|---|---|
| *activity so that the total number of ECTS credits is equal to the ECTS value of the course)* | Essay | | Seminar essay | | (Other) | |
| | Tests | 0.8 | Oral exam | 0.7 | (Other) | |
| | Written exam | 0.7 | Project | | (Other) | |

| | |
|---|---|
| Grading and evaluating student work in class and at the final exam | Continuous evaluation:<br>The entire exam can be passed over two colloquium during the semester. Pass threshold for each colloquium is 50%. Each colloquium participates with 35% in a final grade. Laboratory exercises (50-100% success) participate with 20% in a final grade, while attending lectures in 80-100% amount is 10% of a final grade.<br>Final evaluation:<br>One passed colloquium (previous activity) is recognized as 10% of a final grade. The remaining part is taken on written and oral exam at prescribed examination terms. Written exam accounts for 30%, oral exam for 40%, while laboratory exercises account for 20% of a final grade, respectively.<br>Students who did not take or pass colloquiums take written and oral exam at prescribed examination terms. Passing threshold is 50%. Written exam accounts for 40%, oral exam for 40%, while laboratory exercises account for 20% of a final grade, respectively.<br>Grades definitions and percentages: sufficient (50-61%), good (62-74%), very good (75-87%), excellent (88-100%). |

| | **Title** | **Number of copies in the library** | **Availability via other media** |
|---|---|---|---|
| Required literature (available in the library and via other media) | M. Šercer, D. Opsenica, G Barić, Oporaba plastike i gume, Mtg topograf d.o.o., Velika Gorica, 2000.; | 1 | |
| | A. Azapagić, A. Emsley; I. Hamerton, Polymers, The Environment and Sustainable Development, Wiley, 2003. | 1 | |
| | J. Scheirs, Polymer Recycling: Science, Technology and Applications, John Wiley&Sons, Chichester, 1998. | 1 | |

| | |
|---|---|
| Optional literature (at the time of submission of study programme proposal) | L. Lundquist, Y. Leterrier, P. Sunderland, J.E. Manson, Life Cycle Engineering of Plastics, Elsevier, Oxford, 2000.; A. L. Andrady, Plastics and the Environment, Wiley-Interscience, 2003.; M. Črnjak, K. Črnjar, Menadžment održivog razvoja, AKD, Zagreb, 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) | |

# Nanotechnology and the Environment

| **COURSE NAME** | **Nanotechnology and the Environment** | | | | | |
|---|---|---|---|---|---|---|
| **Course code** | KTC216 | Year of study | 1st | | | |
| **Course lecturer** | PhD, Magdi Lučić Lavčević, associate prof. | Credits (ECTS) | 4.5 | | | |
| Assistants | | Type of instruction | P | S | V | T |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | 30 | 15 | 0 | 0 |
| Course status | Elective | Application of e-learning (percentage) | | | | |

**COURSE DESCRIPTION**

| | |
|---|---|
| Course objectives | Preview of the fundamentals of nanotechnology, analysis of its possible impact on the environment and its possible applications in the protecting of environment. |
| 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) | The knowledge of fundamentals of nanotechnology.<br>The ability of estimate possible impacts of technology on the environment.<br>The knowledge of nanotechnology-based methods used in monitoring, protecting and remediation of environment. |
| Course content broken down in detail by weekly class schedule (syllabus) | Nanoparticles, nanomaterials and nanotechnology (3). The use of nanotechnology in environmental protection (3+3). Potential impacts of nanotechnology on the environment (3+3). Toxicology and biological effects of nanomaterials (3+3). Geochemistry of nanoparticles in air and water (3). Metrology nanomaterials (3). The sensors based on nanotechnology for monitoring chemical and biological parameters of environment (3+3). Production of "green" energy based on nanotechnology (3+1). Catalysts (3). Treatment of water pollution and emissions (3+2).<br>Number of hours of lectures and seminars (L + S) are indicated in brackets. |

| | | |
|---|---|---|
| Format of instruction | **x** lectures<br>☐ seminars and workshops<br>☐ exercises<br>☐ *on line* in entirety<br>☐ partial e-learning<br>☐ field work | ☐ independent assignments<br>**x** multimedia<br>☐ **l**aboratory<br>☐ **work with mentor**<br>**x** group and individual tutorials<br>**x** seminars |
| Student responsibilities | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| 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 | 1 | Research | | Practical training | |
| | Experimental work | | Report | | Pre-test preparation classes | |
| | Essay | | Seminar essay | 1 | (Other) | |
| | Tests | 1 | Oral exam | 1 | (Other) | |
| | Written exam | | Project | | (Other) | |

| | | | |
|---|---|---|---|
| Grading and evaluating student work in class and at the final exam | During the semester, the final exam can be substituted by midterm tests and seminar essays (analysis of selected examples).<br>In the final exam perods the final exam shall be taken after the presentation of seminar essays.<br>Grades: 55-64% - sufficient; 65-79% - good, 80-89% - very good; 90-100% - excellent | | |
| Required literature | **Book title** | **Number of** | **Available via** |

| | | | |
|---|---|---|---|
| (available in the library and via other media) | | **books in the library** | **other media** |
| | M. Lučić Lavčević, Nanostrukture , 2014, internal script | | Personal web-site |
| | Introduction to nanoscale science and technology, M. Di Ventra et al. (Eds.), Springer-Verlag, 2004 | *1* | - |
| | | | |
| Optional literature | Nanostructured catalysts, S.L. Scott (Ed.), Springer-Verlag, 2003. | | |
| 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) | | | |

# Product Life Cycle Assessment (LCA)

| **NAME OF THE COURSE** | **PRODUCT LIFE CYCLE ASSESSMENT (LCA)** | | | | | |
|---|---|---|---|---|---|---|
| Code | KTC220 | Year of study | 2. | | | |
| Course teacher | Dr. Matko Erceg, Associate Professor | Credits (ECTS) | 4.5 | | | |
| Associate teachers | | Type of instruction (number of hours) | P | S | V | T |
| | | | 30 | 15 | 0 | 0 |
| Status of the course | Elective | Percentage of application of e-learning | 0 % | | | |
| **COURSE DESCRIPTION** | | | | | | |
| Course objectives | Provide a comprehensive understanding of the life cycle assessment (LCA) as a standardized ecological tool to compare different products and processes with regard to their impact on the environment. | | | | | |
| Course enrollment requirements and entry competences required for the course | None | | | | | |
| Learning outcomes expected at the level of the course (4 to 10 learning outcomes) | After passing the exam,the student is expected to be able to:<br>• understand and use the concepts of sustainable development and environmental policy<br>• become familiar with the laws and regulations related to the environmental protection<br>• use standardized approach to product life cycle assessment<br>• prepare and present a simple project concerning the environment protection<br>• apply computer applications in the field of LCA method<br>• develop critical thinking skills in the evaluation of the results of LCA methods. | | | | | |
| Course content | 1st week: The environment: environmental systems, sources of pollution, | | | | | |

<table>
<tr><td>broken down in detail by weekly class schedule (syllabus)</td><td colspan="6">anthropogenic pollution, the consequences of environmental pollution (ecological boomerang).<br>2nd week: Sustainable development and environmental policy.<br>3rd week: The legal system of environmental protection in the world and Croatia.<br>4th week: Environmental Management: concept and mission. Environmental Management Systems, ISO 14001.<br>5th week: The life cycle approach: Life Cycle Thinking (LCT), Life Cycle Initiative (LCI), Life Cycle Assessment (LCA), Life Cycle Management ( LCM).<br>6th week: Discussion on the previous subjects. Conclusions.<br>7th week: Standardization of the life cycle assessment: ISO 14040 and ISO 14044.<br>8th week: The structure of LCA method (Part 1).<br>9th week: The structure of LCA method (Part 2).<br>10th week: Computer programs (softwares) for the LCA analysis - LCA analysis on selected examples (Part 1)<br>11th week: Computer programs (softwares) for the LCA analysis - LCA analysis on selected examples (Part 2).<br>12th week: The advantages and disadvantages of the LCA approach. Selected examples.<br>13th week: Application areas of the LCA: design for the environment, improvement of products (technology), strategic planning, marketing, lowering costs.<br>14th week: Knowledge management in the environmental protection - the mission of the educational system in the environmental protection.<br>15th week: The final lecture. Discussion on previous subjects. Conclusions.<br>SEMINAR:<br>The seminar will be used for further analysis and discussion following lectures. Students will also receive individual and group tasks (projects) that will solve and present at the seminar.</td></tr>
<tr><td>Format of instruction</td><td colspan="3">X lectures<br>X seminars and workshops<br>☐ exercises<br>☐ on line in entirety<br>☐ partial e-learning<br>☐ field work</td><td colspan="3">X independent assignments<br>X multimedia<br>☐ laboratory<br>☐ work with mentor<br>☐ (other)</td></tr>
<tr><td>Student responsibilities</td><td colspan="6">Attending lectures and seminars in the amount of 80% of the total hourly rate. Individual and group assignments (projects) and their presentation. Active participation during lessons.</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>1.5</td><td>Research</td><td>0.0</td><td>Practical training</td><td>0.0</td></tr>
<tr><td>Experimental work</td><td>0.0</td><td>Report</td><td>0.0</td><td>Exercises tests study (Other)</td><td>0.0</td></tr>
<tr><td>Essay</td><td>0.0</td><td>Seminar essay</td><td>0.0</td><td>Report from the exercises (Other)</td><td>0.0</td></tr>
<tr><td>Tests</td><td>0.9</td><td>Oral exam</td><td>0.7</td><td>(Other)</td><td></td></tr>
<tr><td>Written exam</td><td>0.8</td><td>Project</td><td>0.6</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">Continuous evaluation:<br>The entire exam can be passed over two colloquia during the semester. The pass threshold for each colloquium is 60%. Each colloquium participates with 45% in a final grade. Attending lectures in 80-100% amount is 10% of a final grade.<br>Final evaluation:<br>One passed colloquium (previous activity) is recognized as 10% of a final grade.</td></tr>
</table>

| | | | |
|---|---|---|---|
| | The remaining part is taken on written and oral exam at prescribed examination terms. Written exam accounts for 40% and oral exam for 50%.<br>Students who did not take or pass colloquiums take written and oral exam at prescribed examination terms. The pass threshold is 60%, while written and oral exam account for 50% of a final grade, respectively.<br>Grades definitions and percentages: sufficient (60-69%), good (70-79%), very good (80-89%), excellent (90-100%). | | |
| Required literature (available in the library and via other media) | **Title** | **Number of copies in the library** | **Availability via other media** |
| | J. Guinee, Handbook on Life Cycle Assessment: Operational Guide to ISO Standards, Kluwer Academic Publishers, New York, 2002. | | pdf |
| | M. Črnjak, K. Črnjar, Menadžment održivog razvoja, AKD, Zagreb, 2009. | | pdf |
| | H. Wenzel, M. Hauschild, L. Alting, Environmental Assessment of Products, Volume ½, Kluwer Academic Publishers, New York, 2002. | | pdf |
| Optional literature (at the time of submission of study program proposal) | Scientific and technical papers of the subject area. | | |
| Quality assurance methods that ensure the acquisition of exit competencies | Quality and success will be monitored on three levels:<br>(1) University level, (2) faculty level and (3) teacher level. | | |
| Other (as the proposer wishes to add) | | | |

# Study on the Environmental Impact

| **NAME OF THE COURSE** | **STUDY ON THE ENVIRONMENTAL IMPACT** | | | | | |
|---|---|---|---|---|---|---|
| **Code** | KTC 203 | Year of study | 2. | | | |
| Course teacher | PhD Marina Trgo, prof. | Credits (ECTS) | 5.0 | | | |
| Associate teachers | - | Type of instruction (number of hours) | P | P | P | P |
| | | | 30 | 30 | 0 | 0 |
| Status of the course | Elective | Percentage of application of e-learning | - | | | |
| **COURSE DESCRIPTION** | | | | | | |
| Course objectives | The aim of the course is to get knowledge about analysis of environmental impact of any activity in the environment. They will able to analyse location of the impact, environmental sensitivity, to create base of all discharges and evaluate their impacts. | | | | | |
| Course enrolment requirements and entry competences required for the course | | | | | | |
| Learning outcomes expected at the | It is expected that the learning outcomes provide knowledge about: | | | | | |

| | |
|---|---|
| level of the course (4 to 10 learning outcomes) | - Activities which needs elaborate of environmental impact<br>- Ability to identify impacts<br>- Methods development for evaluation and pondering of environmental impacts<br>- Elaborate performance. |
| Course content broken down in detail by weekly class schedule (syllabus) | 1st week: Importance of Environmental impact elaborate as document according to directive 97/11/EC.<br>2nd week: Types of activities which needs evaluation of environmental impact<br>3rd week: definition of the main steps and criteria for evaluation<br>4th week: Screening and scoping of the project idea.<br>5th week: Prediction of specific impacts, evaluation of importance.<br>6th week: Techniques of collecting data and analysis of particular impact<br>7th week: Analysis of location of the project, geological and hydrographical situation related to climatic conditions<br>8th week: Flora and fauna analysis, distance from buildings.<br>10th week: Interaction of the project with live organisms, application of the models..<br>11th week: Definition of the mail elements for elaborate as document.<br>12th week: Suggestion of methods of protection according to positive practice examples.<br>13th week: Presentation of the elaborate, resting of modelled impacts. Evaluation of the costs of the project.<br>14th week: Methods of decreasing of the negative impacts and disabling of extreme negative impacts.<br>15th week: Interdisciplinary approach to the environmental evaluation, publication of results.<br>SEMINARS:<br>1st week: Law regulative in area of environmental protection.<br>2nd week: Analysis of the Study of environmental impact of the Centre for the solid waste treatment – part 1.<br>3rd week: Analysis of the Study of environmental impact of the Centre for the solid waste treatment – part 2.<br>4th week: Analysis of the Study of environmental impact of the Centre for the solid waste treatment – part 3.<br>5th week: Analysis of the Study of environmental impact of the Marine with tourist accommodation – part 1.<br>6th week: Analysis of the Study of environmental impact of the Marine with tourist accommodation – part 2.<br>7th week: Analysis of the Study of environmental impact of the Marine with tourist accommodation – part 3.<br>8th week: Analysis of the Study of environmental impact of the solid waste incineration – part 1.<br>9th week: Analysis of the Study of environmental impact of the solid waste incineration – part 2.<br>10th week: Analysis of the Study of environmental impact of the solid waste incineration – part 3.<br>11th week: Analysis of the Study of environmental impact of the fish aquaculture growing plant – part 1.<br>12th week: Analysis of the Study of environmental impact of the fish aquaculture growing plant – part 2.<br>13th week: Analysis of the Study of environmental impact of the fish aquaculture growing plant – part 3. |

<table>
<tr><td></td><td colspan="6">14th week: Oral presentations of the students.<br>15th week: Oral presentations of the students.</td></tr>
<tr><td>Format of instruction</td><td colspan="3">☒ lectures<br>☒ seminars and workshops<br>☐ exercises<br>☐ on line in entirety<br>☐ partial e-learning<br>☐ field work</td><td colspan="3">☒ independent assignments<br>☒ multimedia<br>☐ laboratory<br>☐ work with mentor<br>☐ (other)</td></tr>
<tr><td>Student responsibilities</td><td colspan="6">Attending lectures is 80%, while seminars 100% of the total hours.</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>1.5</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>(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>0.5</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>Grading and evaluating student work in class and at the final exam</td><td colspan="6">Final written exam or two partial exams (50% of the total evaluation).<br>A written essay (25% of the total evaluation).<br>Oral presentation of written seminar paper (20% of the total evaluation) and poster presentation based on a written seminar paper (5% of the total evaluation). Passing threshold is 60%. Grades: successful (60% – 69%), good (70% – 79%), very good (80% – 89%), excellent (90% – 100%).</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">PPT presentation</td><td>-</td><td>Course teacher</td></tr>
<tr><td colspan="3">Studija o utjecaju na okoliš za zahvat-izgradnja pomorskih i kopnenih objekata na ,prostoru "Giričić"-Kaštel Gomilica , Hidroelektra-projekt d.o.o., Zagreb, 2004.</td><td>1</td><td>Course teacher</td></tr>
<tr><td colspan="3">Studija o utjecaju na okoliš centra za gospodarenje otpadom Dubrovačko-neretvanske županije, IPZ Uniprojekt, Zagreb, 2010.</td><td>1</td><td>Course teacher</td></tr>
<tr><td colspan="3">A. Gilpin, Environmental Impact Assessment; Cutting Edge for the 21st Century, Cambridge University Press, Cambridge, UK, 1995.</td><td>1</td><td>Course teacher</td></tr>
<tr><td>Optional literature (at the time of submission of study programme proposal)</td><td colspan="6">Directive 97/11/EC</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:<br>(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">Suggestions and reactions of participants during the semester.<br>Student survey.</td></tr>
</table>

# Energy and Development

| COURSE NAME | Energy and Development | | | | | |
|---|---|---|---|---|---|---|
| **Course code** | KTC217 | Year of study | 2nd | | | |
| **Course lecturer** | PhD, Mirko Marušić, senior lecturer | Credits (ECTS) | 3.0 | | | |
| Assistants | | Type of instruction | L | S | E | F |
| | | | 30 | 0 | 0 | 0 |
| Course status | Mandatory | 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.<br>- Describing the ways in which electricity can be produced.<br>- Describing the ways in which nuclear energy can be used and analyizing the operation of a nuclear power plant.<br>- Defining and describing the types of renewable energy sources.<br>- Describing the basic characteristics of water energy usage.<br>- Describing the ways in energy of the sun can be used and its basic characteristics.<br>- Describing the basic characteristics of the usage of wind energy.<br>- Describing the ways in which geotermal energy and biomass energy can be used, as well as their basic characteristics.<br>- 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.<br>- 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.<br>- 3rd week: Energy of fossil fuels: coal.<br>- 4th week: Energy of fossil fuels: oil.<br>- 5th week: Energy of fossil fuels: natural gas. Partial assessment (1st preliminary test)<br>- 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.<br>- 8th week: Nuclear energy: fission.<br>- 9th week: Nuclear reactors.<br>- 10th week: Nuclear fuels. Partial assessment (2nd preliminary test)<br>- 11th week: Nuclear fusion, projects of fusion devices.<br>- 12th week: Influence of nuclear energy on mankind and environmente.<br>- 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).<br>- 14th week: Wind energy: basic characteristics, wind turbines, wind-electric power plants.<br>- 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). |
| Format of instruction | **X** lectures<br>☐ seminars and workshops<br>☐ exercises<br>☐ *on line* in entirety<br>☐ partial e-learning<br>**X** field work<br>☐ independent assignments<br>**X** multimedia<br>☐ laboratory<br>☐ work with mentor<br>**X** group and individual tutorials<br>☐ seminars |
| Student responsibilities | |

| 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 | 1 | Research | | Practical training | |
| | Experimental work | | Report | | Pre-test preparation classes | |
| | 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 | In course of the semester, the entire exam can be passes by taking and passing the three preliminary tests consisting of theoretical questions.<br>In the examination periods oral exam is taken.<br>Grades: 55-64% - sufficient; 65-79% - good, 80-89% - very good; 90-100% - excellent. |

| Required literature (available in the library and via other media) | **Book title** | **Number of books in the library** | **Available via other media** |
|---|---|---|---|
| | Internal script | | Web portal |
| | | | - |
| | | | - |

| | |
|---|---|
| Optional literature | D. Krpan-Lisica, Osnove energetike, Hinus, Zagreb, 2001.<br>C.J. Cleveland, Editor, Encyclopedia of Energy, Vol.1-6, Elsevier, San Diego 2004.<br>H. Požar, Osnove energetike 1,2, Školska knjiga, Zagreb, 1992.<br>V. Knapp, Novi izvori energije 1, Školska knjiga, Zagareb, 1993. |

| | |
|---|---|
| | P. Kulišić, Novi izvori energije 2, Školska knjiga, Zagreb, 1991. |
| Quality assurance methods that ensure the acquisition of exit competences | Quality assurance will be performed at three levels:<br><br>(1) University Level; (2) Faculty Level by Quality Control Committee; (3) Lecturer's Level. |
| Other (as the proposer wishes to add) | |

# Sanitary Landfill Disposals

| **NAME OF THE COURSE** | **SANITARY LANDFILL DISPOSALS** | | | | | |
|---|---|---|---|---|---|---|
| **Code** | | Year of study | 2. | | | |
| Course teacher | PhD Marina Trgo, prof. | Credits (ECTS) | 5.0 | | | |
| Associate teachers | | Type of instruction (number of hours) | P | P | P | P |
| | | | 30 | 15 | 0 | 0 |
| Status of the course | Elective | Percentage of application of e-learning | | | | |
| **COURSE DESCRIPTION** | | | | | | |
| Course objectives | The aim of the course is to introduce students on planning, projecting, use and closing procedures of the landfills. Should know elements of the landfill, producing of the leachate and gases as well as their impact on the environment related to Croatian legislative. | | | | | |
| Course enrolment requirements and entry competences required for the course | | | | | | |
| Learning outcomes expected at the level of the course (4 to 10 learning outcomes) | It is expected that the learning outcomes provide knowledge about:<br>- Importance of regular landfill organization<br>- Building new centre for waste management<br>- Establishment of the recycling yards<br>- Introducing into bioreactor landfills<br>- Planning and guidelines for projecting of new landfills. | | | | | |
| Course content broken down in detail by weekly class schedule (syllabus) | 1st week: Introductory lecture. Solid waste classification, illegal landfills, Croatian regulations regarding unregularly disposed waste.<br>2nd week: Evaluation of the situation on improper disposal areas, compressively stolid waste.<br>3rd week: Sampling of the solid, liquid and gaseous samples on the landfill for characterisation of the waste. Comparison with legal disposal, examples of good practice.<br>4th week: Analysis of produced gasses for evaluation of landfill age, phases of the degradation.<br>5th week: Leachate composition, evaluation of the age depending of leachate characteristics. Methods and apparatus for leachate treatment. Stripping, physic-chemical treatment.<br>6th week: Description of the recommended treatment technologies, in situ and ex situ procedure. | | | | | |

<table>
<tr><td></td><td colspan="6">7th week: Projecting of the new landfill, basement construction elements.<br>8th week: leachate drainage systems, methods for collecting and use of gaseous.<br>9th week: Underground natural waters protection, inhibition of infiltration.<br>10th week: infrastructure of the landfill, recycling yard organization and management.<br>11th week: Mechanical and biological treatment (MBT) combined with bioreactor landfill.<br>12th week: Storm water infiltration in disposed waste. Evaluation models, climatic impacts.<br>13th week: Covering of the disposed waste to prevent loosing of the material.<br>14th week: Closing and monitoring procedures of the landfill.<br>15th week: Cost-benefit analysis according to Croatian laws.<br><br>SEMINAR:<br>1st week: Guidelines for local plan for waste management – part 1.<br>2nd week: Guidelines for local plan for waste management – part 2.<br>3rd week: Analysis of landfill gasses, example for calculation<br>4th week: Establishment of the degradation model<br>5th week: Analysis of the leachate composition results.<br>6th week: Calculations for re-use of the old waste on the illegal landfill<br>7th week: Material balance for known solid waste.<br>8th week: Analysis of the Study on the environmental impact for landfill “Borovik” on the island Šolta, part 1.<br>9th week: Analysis of the Study on the environmental impact for landfill “Borovik” on the island Šolta, part 2.<br>10th week: Analysis of the Study on the environmental impact for landfill “Borovik” on the island Šolta, part 3.<br>11th week: Analysis of the project for landfill Kutina, part 1.<br>12th week: Analysis of the project for landfill Kutina, part 2.<br>13th week: Analysis of the project for landfill Kutina, part 3.<br>14th week: Croatian legislative in waste management.<br>15th week: EU directives related to waste management.<br>x</td></tr>
<tr><td>Format of instruction</td><td colspan="3">☒ lectures<br>☒ seminars and workshops<br>☐ exercises<br>☐ on line in entirety<br>☐ partial e-learning<br>☒ field work</td><td colspan="3">☐ independent assignments<br>☐ multimedia<br>☐ laboratory<br>☐ work with mentor<br>☐ (other)</td></tr>
<tr><td>Student responsibilities</td><td colspan="6">Attending lectures is 80%, while seminars 100% of the total hours.</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>(Other)</td><td></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>1.0</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 colspan="6"></td></tr>
<tr><td>Grading and evaluating student</td><td colspan="6">Final written exam or two partial exams (80% of the total evaluation).</td></tr>
</table>

| | | | |
|---|---|---|---|
| work in class and at the final exam | A written essay (20% of the total evaluation).<br>Passing threshold is 60%. Grades: successful (60% – 69%), good (70% – 79%), very good (80% – 89%), excellent (90% – 100%). | | |
| Required literature (available in the library and via other media) | **Title** | **Number of copies in the library** | **Availability via other media** |
| | MPTT presentation | - | Course teacher |
| | V. Silborčić, Kako sastaviti, objaviti i ocijeniti znanstveno djelo, Zagreb, Medicinska naklada, 2003. | | Course teacher |
| | Priručnik za statističke podatke o otpadu, Agencija za zaštitu okoliša, Zagreb, 2014. | | Course teacher |
| | Plan gospodarenja otpadom u RH 2007.-2015. NN 85/2007.; 126/2010.; 31/2011. | | Course teacher |
| | R Cossu, H van der Sloot Sustainable Landfilling, CISA Publisher 2013. | 1 | Course teacher |
| | Qian, X., Koerner, R.M., Gray, D.H.: Geotechnical Aspects of Landfill Design and Construction, Prentice Hall, Inc., 2002. | | Course teacher |
| | Proceedings of 10th International Waste Management and Landlill Symposium, Cagliari, Sardinia, 2005. | | Course teacher |
| | Strategija gospodarenja otpadom Republike Hrvatske, NN 130/2005. | 1 | Course teacher |
| | Jahić, M.: Sanitarne deponije, Univerzitet u Bihaću, Tehnički fakultet, Bihać, 2006. | | Course teacher |
| | V. Orešćanin, Procjedne vode odlagališta otpada – Kemijski sastav, toksični učinci i metode pročišćavanja, Hrvatske vode, 22(2014) 1-12. | | Course teacher |
| | IDEJNI PROJEKT sanacije odlagališta s nastavkom odlaganja i planom zatvaranja na lokaciji “Jerovec” - Ivanec, IPZ Uniprojekt MCF, Zagreb, 2005. | | Course teacher |
| Optional literature (at the time of submission of study programme proposal) | Directive 2006/12/EC,<br>Directive 1999/31/EC,<br>Directive 91/689/EEC, 94/31/EC, 166/2006,<br>Directive 86/278/EEC,<br>Directive 2000/76/EC,<br>Directive 94/62/EC, 2005/20/EC, 2004/12/EC, 1882/2003. | | |
| Quality assurance methods that ensure the acquisition of exit competences | Quality assurance will be performed at three levels:<br>(1) University Level; (2) Faculty Level by Quality Control Committee; (3) Lecturer’s Level | | |
| Other (as the proposer wishes to add) | Suggestions and reactions of participants during the semester.<br>Student survey. | | |

# Chemical Ecology

| **NAME OF THE COURSE** | **CHEMICAL ECOLOGY** | | |
|---|---|---|---|
| Code | KTC 223 | Year of study | 2st year of graduate study |

<table>
<tr><td>Course teacher</td><td>Assoc. prof. Ph. D.Marija Bralić</td><td>Credits (ECTS)</td><td colspan="4">5.0</td></tr>
<tr><td rowspan="2">Associate teachers</td><td rowspan="2">Senior Assistent:<br>Ph. D. Maša Buljac<br><br>Laboratory assistent:<br>Marica Mijić</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>Optional</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">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.<br>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 :<br>1. definition of basic concepts and history of chemical ecology<br>2. the origin of the chemical constituents in the ecosystem<br>3. classification and labelling of hazardous chemicals<br>4. transport mechanisms in the environment<br>5. sources of pollution as a result of human activity<br>6. interactive impact of pollutants<br>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<br>Lecture 2: Identification of chemical components in the ecosystems, natural resources.<br>Lecture 3: Risk assessment of pollutants<br>Lecture 4: The main disturbances in ecosystems caused by human activities<br>Lecture 5: Overview of the sources of pollution as a result of human activity<br>Lecture 6:Distribution of pollutants. Pesticides, metals, fertilizers, mechanisms of toxicity<br>Lecture 7: The first midterm test<br>Lecture 8: Physical and chemical properties<br>Lecture 9:.The transport mechanisms in soil, water and air<br>Lecture 10: Bioaccumulation and bioconcentration in organisms and ecosystems<br>Lecture 11:The excretion of toxic substances from the organism<br>Lecture 12:Mitigation of biodegradation<br>Lecture 13: Sources and effects of contamination. Determination of risk from an environmental point of view<br>Lecture 14: The classification and labeling of hazardous chemicals. Legislation and toxicological tests in Croatia and the EU.<br>Lecture 15: The second midterm test</td></tr>
</table>

| | |
|---|---|
| | **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. |
| Format of instruction | ×lectures<br>☐seminars and workshops<br>×exercises<br>□*on line*in entirety<br>□partial e-learning<br>□field work<br>□independent assignments<br>□multimedia<br>×laboratory<br>□work with mentor<br>□ (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 | 0.7 | Research | | Practical training | |
| | Experimental work | 1.0 | Report | | (Other) | 0.3 |
| | Essay | | Seminar essay | | (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 | 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** |
|---|---|---|---|
| | C.H.Walker,S.P.Hopkin, R.M. Sibly, D.B. Peakall. Principles of Ekotoxicology, Taylor&Francis,London, 2006. | | 1<br>1 |
| | B.L. Carson, H.V.Ellis III, J.L.McCann. Toxicology and biological monitoring of metals in humans, 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 | V.Srebočan. Veterinarska toksikologija, Medicinska naklada, Zagreb, 2009.<br><br>L. Robinson, I. Thorn. Toxicology and Ecotoxicology in chemical safety assessment, | | |

| | |
|---|---|
| programme proposal) | 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) | |

# General Biology

| **NAME OF THE COURSE** | **General Biology** | | | | | |
|---|---|---|---|---|---|---|
| **Code** | KTC 101 | Year of study | 1st | | | |
| Course teacher | PhD, Nada Bezić, prof. | Credits (ECTS) | 4.0 | | | |
| Associate teachers | PhD, Valerija Dunkić, associate prof. | Type of instruction (number of hours) | L | S | E | F |
| | | | 30 | | 15 | |
| Status of the course | Mandatory | Percentage of application of e-learning | 0 | | | |

**COURSE DESCRIPTION**

| | |
|---|---|
| Course objectives | Students learn to:<br>• Introduce students to the relationships of animate and inanimate nature<br>• Understand the basic principles of cell biology<br>• mastering the basics of genetics and ecological relationships among organisms |
| 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 after the course unit power:<br>• Recognize the importance of living organisms in relation to the environment<br>• To master the basic knowledge of cell biology and evolution of organisms<br>• Know the basic genetic principles<br>• Know how environmental changes affect the ecosystem changes |

| Course content broken down in detail by weekly class schedule (syllabus) | Content - hours | L | V |
|---|---|---|---|
| | Animate and inanimate nature. | 3 | 1 |
| | Prokaryotes, eukaryotes, relationships between plants-animals | 3 | 1 |
| | Membranes and transport through the membrane, nucleus, nucleolus | 3 | 1 |
| | DNA, RNA, CD-biology, Endoplasmic reticulum, Golgi apparatus, lysosomes | 3 | 1 |
| | Mitochondria - breathing, chloroplasts - photosynthesis, peroxisomes | 3 | 1 |
| | Cell cycle, mitosis, meiosis (spermatogenesis, oogenesis), fertilization | 3 | 1 |
| | The embryonic development model operon differentiation in plants and animals | 3 | 1 |

| | | | |
|---|---|---|---|
| | | | |
| | Aging and death, viruses (HIV), tumors | 3 | 1 |
| | The basics of inheritance, Mendel's laws, mutations | 3 | 1 |
| | Ecological concepts and relationships of organisms in the biocenosis | 3 | 1 |

| | | |
|---|---|---|
| Format of instruction | x **lectures**<br>☐ seminars and workshops<br>x **exercises**<br>☐ *on line*in entirety<br>☐ partial e-learning<br>☐ field work | ☐ independent assignments<br>☐ multimedia<br>☐ laboratory<br>☐ work with mentor<br>☐ (other) |
| Studentresponsibilities | Admission to the lectures of at least 70%, as well as seminars and seminar work in 100% of scheduled classes. | |

| 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** | 2 |
| | Experimental work | | Report | | (Other) | |
| | Essay | | Seminar essay | | (Other) | |
| | Tests | | Oral exam | | (Other) | |
| | **Written exam** | 3 | Project | | (Other) | |

| | |
|---|---|
| Grading and evaluating student work in class and at the final exam | The obligation is to the students during the course of hearing preparation seminar that also must know the present. Upon completion of the lecture can be the time to take the entire test period courses in writing. |

| Required literature (available in the library and via other media) | **Title** | **Number of copies in the library** | **Availability via other media** |
|---|---|---|---|
| | Literatura the Webb Science | | |
| | G. M. Cooper, The Cell: A Molecular Approach, ASM Press. Washington , D.C. 2004. | | |

| | |
|---|---|
| Optional literature (at the time of submission of study programme proposal) | A.Delić i N. Vijtiuk, Prirodoslovlje, Školska knjiga, Zagreb, 2004. |
| Quality assurance methods that ensure the acquisition of exit competences | Quality of the teaching and learning, monitored at the level of the<br>(1) teachers, accepting suggestions of students and colleagues, and<br>(2) faculty, conducting surveys of students on teaching quality. |
| Other (as the proposer wishes to add) | |

# Hygiene and Sanitation

| **NAME OF THE COURSE** | **Hygiene and Sanitation** |
|---|---|

| **Code** | KTD 104 | Year of study | 1st | | | |
|---|---|---|---|---|---|---|
| Course teacher | PhD, Tea Bilušić, prof. | Credits (ECTS) | 6.0 | | | |
| Associate teachers | PhD, Mirjana Skočibušić, associate prof. | Type of instruction (number of hours) | L | S | E | F |
| | | | 30 | 15 | 15 | 0 |
| Status of the course | Mandatory | Percentage of application of e-learning | 35% | | | |

**COURSE DESCRIPTION**

| | |
|---|---|
| Course objectives | Acquiring a basic knowledge on<br>- distiniquishig and understanding of major food risks<br>- understanding of principles of food hygiene in food industry<br>- controlling of food storage and food distribution in order to enhance of food shelf-life<br>- determination of food contaminants<br>- application of food hygene practice as well as HCCP |
| 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 completing the course, the student will become familiarized with the major concepts of hygene and sanitation in food industry, which includes:<br>- to distinquish and recognize major risks characteristic for selected food class<br>- the knowledge on conditions which can cause food deterioration<br>- to apply hygene and sanitation practice in order to keep food safety<br>- to apply HCCP as a method for control the food safery |
| Course content broken down in detail by weekly class schedule (syllabus) | **1.** Introduction. Bioterorism, factors affecting climate in relation to food safety. L (1h)<br>**2.** Water safety in food industry. L (2h), S (1h)<br>**3.** Chemical and physical contaminants in foods. L (2h), S (1h)<br>**4.** Microorganims in food and food-borne illnesses. L (1h)<br>**5.** Micotoxins and food alergenes. L (2h), S (1h)<br>**6.** Sources of food contamination. L (2h), S (1h)<br>**7.** Deterioration and hygene measures of plant-derived food: Cereals. L (2h), S (1h)<br>**8.** Deterioration and hygene measures of plant-derived food: Fruits and vegetables. L (2h), S (1h)<br>**9.** Deterioration and hygene measures of animal-derived food: Red meat. L (2h), S (1h)<br>**10.** Deterioration and hygene measures of animal-derived food: Fish. L (2h), S (1h)<br>**11.** Deterioration and hygene measures of animal-derived food: Milk and dairy products. Eggs. L (2h), S (1h)<br>**12.** Good manufacturing practice. L(1h)<br>**13.** HCCP. L (2h), S (1h)<br>**14.** Sanitation. Sanitizers. L (2h), S (1h)<br>**15.** Disinfection. L (2h), L (1h)<br>**16.** Dezinsection. L (2h), S (1h)<br>**17.** Deratization. L (2h)<br>**18.** CIP i COP systems. L (1h)<br><u>Laboratory exercises:</u> |

<table>
<tr><td></td><td colspan="6">- microbiological tests (food, working place, hands) using API biochemcial strips, rapid tests (reasurin solution and methylene blue)<br>- monitoring of color-changing of meat influenced by different factors (temperature, pH, antioxidants, additives…)<br>- determination of disinfection rate of cleaning compounds (ethanol, isopropanol, bases)</td></tr>
<tr><td>Format of instruction</td><td colspan="3">☒lectures<br>☒seminars and workshops<br>☐exercises<br>☐on line in entirety<br>☐partial e-learning<br>☐field work</td><td colspan="3">☐ndependent assignments<br>☒multimedia<br>☒aboratory<br>☐work with mentor<br>☐(other)</td></tr>
<tr><td>Studentresponsibilities</td><td colspan="6">Lectures attendance - at least 70% of full schedule; attendance on seminar work – at least 80% of full schedule. To design the seminar work on selected topic</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></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>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></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 written exams are provided (as partical examinations). Test will be carried out within 60 minutes. Students who obtain positive mark from both exams, will have oral examination in order to obtain the final mark. During semester, students should present their seminar work on selected topic within this course. The final mark of this course will count the mark from seminar work, marks from written exams, and mark from oral exams.</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">V. Turčić. HACCP i higijena namirnica. Filedata, Zagreb, 2000.</td><td>1</td><td colspan="2"></td></tr>
<tr><td colspan="3">R. K. Guthrie. Food Sanitation. Avi, New York, 1988.</td><td>1</td><td colspan="2"></td></tr>
<tr><td colspan="3">N. G. Marriot, R.B. Gravani. Principles of Food Sanitation. Springer, 2006.</td><td>1</td><td colspan="2"></td></tr>
<tr><td>Optional literature (at the time of submission of study programme proposal)</td><td colspan="6">A Asaj. Zdravstvena dezinskecija u nastambama i okolišu. Medicinska naklada, Zagreb, 1999.<br>A. Asaj. Deratizacija u praksi. Medicinska naklada. Zagreb, 1999.</td></tr>
<tr><td>Quality assurance methods that ensure the acquisition of exit competences</td><td colspan="6">• registration of student's presence in class<br>• annual analysis of students success in this course<br>• student's survey in order to evaluate the professor<br>• professor's self-evaluation</td></tr>
<tr><td>Other (as the proposer wishes to add)</td><td colspan="6"></td></tr>
</table>

# Biochemical Engineering

<table>
<tr><td colspan="2">NAME OF THE COURSE</td><td colspan="5">Biochemical Engineering</td></tr>
<tr><td>Code</td><td>KTD 107</td><td>Year of study</td><td colspan="4">1st</td></tr>
<tr><td>Course teacher</td><td>PhD, Davor Rušić, prof.</td><td>Credits (ECTS)</td><td colspan="4">5.0</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>0</td><td>15</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="7">COURSE DESCRIPTION</td></tr>
<tr><td>Course objectives</td><td colspan="6">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="6"></td></tr>
<tr><td>Learning outcomes expected at the level of the course (4 to 10 learning outcomes)</td><td colspan="6">Student is expected to develop an ability to analyze an engineering aspects of Chemistry and Biochemistry</td></tr>
<tr><td>Course content broken down in detail by weekly class schedule (syllabus)</td><td colspan="6">Week 1: Definition of areas of biochemical engineering, biochemical engineering significance, connections with other areas of science.<br>Week 2: The concept of biological systems.<br>Week 3: Features of engineering fermentation processes.<br>Week 4: Features of engineering enzymatic processes.<br>Week 5: Field of the preparation of the substrate.<br>Week 6: Preparing for the test and systematization of presented lectures<br>Week 7: First test<br>Week 8: Area of bioconversion (introduction)<br>Week 9: The bioreactor as space unfolding biochemical reactions, types of reactors, reactor construction, aerated systems.<br>Week 10: Bioreaction kinetics (reaction kinetics concept, the influence of product and substrate, thermodynamics of the reaction, biocatalysis)<br>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)<br>Week 12: Design and analysis of bioreactors.<br>Week 13: Important biotechnological processes in idustry<br>Week 14: Preparation for second test.<br>Week 15: Second test<br><br>Exercises: Cell counting (Neubauer). Algae substrate preparation. Sterilization - UV light sterilization. Kombucha production. Seminar paper: algae production in photobioreactor.</td></tr>
<tr><td>Format of</td><td colspan="3">x lectures</td><td colspan="3">x independent assignments</td></tr>
</table>

| | | |
|---|---|---|
| instruction | □ seminars and workshops<br>**x** exercises<br>□*on line*in entirety<br>□partial e-learning<br>□field work | □ multimedia<br>**x** laboratory<br>□work with mentor<br>□ seminars |
| Student responsibilities | Regular attendance and active participation at lectures, 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 | 0.5 | Research | | Practical training | |
| | Experimental work | 0.5 | Report | 0.5 | (Other) | |
| | Essay | | Seminar essay | 0.5 | (Other) | |
| | Tests | 2.0 | Oral exam | 1.0 | (Other) | |
| | Written exam | | Project | | (Other) | |

| | |
|---|---|
| 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.<br>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** |
|---|---|---|---|
| | Z.Gomzi, Kemijski reaktori, Hinus, Zagreb 1977 | 10 | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |

| | |
|---|---|
| Optional literature (at the time of submission of study programme proposal) | E.Bailey,D.F.Ollis,Biochemical Engineering Fundamentals,McGraw-Hill.1986.<br>N.F.Millis, Biochemical Engineering ,Academic Press, N,Y.1978. |
| Quality assurance methods that ensure the acquisition of exit competences | **Quality assurance methods that ensure the acquisition of exit competences:**<br>Quality of the teaching and learning, monitored at the level of the<br>(1) teachers, accepting suggestions of students and colleagues, and<br>(2) faculty, conducting surveys of students on teaching quality. |
| Other (as the proposer wishes to add) | |

# Processes in Food Industry

| **NAME OF THE COURSE** | **Processes in Food Industry** | | |
|---|---|---|---|
| **Code** | KTD103 | Year of study | 1st |

| | | | | | | |
|---|---|---|---|---|---|---|
| Course teacher | PhD, Ivana Generalić Mekinić, 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 | Mandatory | Percentage of application of e-learning | | | | |
| **COURSE DESCRIPTION** | | | | | | |
| Course objectives | The course is designed to give basic knowledge of food processing principles and applications. By the end of the course student should know the meaning of the major, general and specific, operations in food-processing engineering. Student should know the most important principles of food preservation and understand the basic principles and applications for major food processing techniques of commercial importance. | | | | | |
| 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 this course, student will be able to:<br>- define different food sector activities and major processes in the food-process engineering,<br>- define objectives and methods of the basic preparatory and specific operations in the food industry,<br>- understand the significance and basic principles of food conservation,<br>- describe and understand food thermal processing methods<br>- define and understand food low-temperature preservation methods (cooling, freezing)<br>- understand the water activity concept and the implementation of environment control in food degradation control and contamination limitation<br>- know and understand the methods of food preservation by dehidratation<br>- describe fermentation and explain food bioconversion principles<br>- describe methods of conservation through addition of sugar, salt and preservatives<br>- understand basic principles of food conservation using microwaves and ionizing radiation | | | | | |
| Course content broken down in detail by weekly class schedule (syllabus) | 1st week: Food industry developmet; Single processes in food industry;<br>2nd week: Classification of raw materials and products; Physical and thermo-physical properties;<br>3rd week: The main causes of food spoilage; Kinetic of food deterioration;<br>4th week: Stability, preservation and safety of food products. Methods of preservation;<br>5th week: Thermal processing (blanching, pasteurization, heat sterilization).<br>6th week: Low-temperature processing; Storage and packaging of food products in controlled atmosphere<br>7th week: I. Colloquium<br>8th week: Food freezing<br>9th week: Food dehydration (evaporation, drying); Concentration processes (membrane processes; freeze drying).<br>10th week: Biological food preservation; Food additives; Methods for conversion of food properties;<br>11th week: Minimal processing and new technologies of food processing;<br>12th week: Mechanical and physical processes in food industry; Extrusion cooking; Extraction; Emulsification;<br>13th week: The production lines. Dynamic and evolution of the food industry;<br>14th week: Important legislations in the field of food industry;<br>15th week: II. Colloquium | | | | | |

<table>
<tr><td>Format of instruction</td><td colspan="3">x lectures<br>x seminars and workshops<br>x exercises<br>☐on line in entirety<br>☐partial e-learning<br>x field work</td><td colspan="3">x independent assignments<br>x multimedia<br>x laboratory<br>☐work with mentor<br>☐ (other)</td></tr>
<tr><td>Studentresponsibilities</td><td colspan="6">Admission to the lectures and seminars of at least 70% of the times scheduled. Students are required to attend laboratory practice and field work 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></td></tr>
<tr><td>Experimental work</td><td></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>2,0</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">The course content is divided into three 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; 60-70% successful (2) 70-80% good (3), 80-90% very good (4), 90-100% excellent (5).</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 colspan="2">Availability via other media</td></tr>
<tr><td colspan="3">Z. Herceg “Procesi u prehrambenoj industriji“ Plejada, Zagreb, 2011</td><td>1</td><td colspan="2"></td></tr>
<tr><td colspan="3">Z. Herceg „ Procesi konzerviranja hrane“, Golden marketing-Tehnička knjiga, zagreb 2009.</td><td>1</td><td colspan="2"></td></tr>
<tr><td colspan="3">T. Lovrić, Procesi u prehrambenoj industriji s osnovama prehrambenog inženjerstva, Hinus, Zagreb, 2003;</td><td>2</td><td colspan="2"></td></tr>
<tr><td colspan="3">G. Campbell-Platt, Food Science and Technology, John Wiley & Sons, Ltd., 2009</td><td></td><td colspan="2">Yes</td></tr>
<tr><td>Optional literature (at the time of submission of study programme proposal)</td><td colspan="6">H. Ramswamy, M. Marcotte, Food processing: Principles and Applications. Taylor&Francis, Boca Raton, 2006.<br>Z. Berk, Food Process Engineering and technology; 1st edition; Academic Press, Elsvier, Amsterdam, 2009<br>J.G. Brennan, Food processing handbook, Wiley-VCH, Weinheim, 2005<br>P. Fellows, Food Processing Technology, 2nd Edition CRC Press, 2000;<br>M.S. Lewis, Physical properties of Foods and Food Processing Systems, VCH Publishers, 1987.<br>D.R. Heldman, R.W. Hartel, Principles of food processing, Chapman and Hall, 1997.<br>J. Larousse, B. Brown, Food canning technology, Wiley-VCH Inc., 1997.</td></tr>
<tr><td>Quality assurance methods that ensure the acquisition of exit</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>
</table>

| | |
|---|---|
| competences | |
| 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, Ana Maravić, 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>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:<br>• better understanding of the evolutionary relationships between structure, diversity and replication of different groups of microorganisms.<br>• learn about genetic mechanisms of adaptation of prokaryotic microorganisms in a variety of environmental conditions.<br>• applied methods of physiological and biochemical tests for the identification of the different groups of microorganisms.<br>• 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.<br>• determine the number of microorganisms in the sample and calculate the growth of microorganisms in controlled laboratory conditions.<br>•</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)<br>2. The distribution of microorganisms and their role in biogeochemical processes in nature. (2 hours)<br>3. Eukaryotes, Archaea and Bacteria; structure and function. Morphology, nomenclature and classification of microorganisms. (2 hours)<br>4. Basic structure and function of prokaryotic and eukaryotic cells. (2 hours)<br>5. Microbial genetics, genome organization, mobile genetic elements. (2 hours)<br>6. The growth of microorganisms and the basic growth factors, nutrients, temperature, oxygen, pH and osmotic pressure. (2 hours)<br>7. Metabolic activity of microorganisms. Identification of microorganisms using various physiological and biochemical tests. (2 hours)<br>8. Microorganisms and diseases, resistance, relationship microorganisms and host immune responses to infection. (2 hours)<br>9. Mechanisms of antimicrobial resistance to antibiotics and other chemical substances. (2 hours)<br>10. Basic morphological characteristics of fungi, yeasts and molds and their pathogenicity. Diseases caused by fungi, and their toxins. (2 hours)<br>11. Application of microorganisms in biotechnology. (2 hours)<br>12. Basic morphological characteristics and development cycles of parasites.<br>13. The role of microorganisms in the biodegradation of heavy metals, nitrate, and chlorinated hydrocarbons. (2 hours)<br>14. Basic morphological characteristics of viruses, viroids and prions. Classification and nomenclature of viruses. Methods of studying properties of the viruses. (2 hours)</td></tr>
</table>

| | |
|---|---|
| | 15. Control the growth of microorganisms by physical and chemical methods. (*2 hours*)<br>**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. |

| | | |
|---|---|---|
| Format of instruction | ☒ectures<br>☒seminars and workshops<br>☒exercises<br>☐*on line*in entirety<br>☐partial e-learning<br>☐field work | ☒independent assignments<br>☒multimedia<br>☒aboratory<br>☐work with mentor<br>☐(other) |
| Student responsibilities | Admission to the lectures in the amount of at least 70% of the times scheduled. Completed all planned laboratory exercises and seminar essay. | |

| 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 | 1.0 | Research | | Practical training | |
| | Experimental work | 1.5 | Report | | (Other) | |
| | Essay | | Seminar essay | 0.5 | (Other) | |
| | Tests | | Oral exam | 1.0 | (Other) | |
| | Written exam | 1.5 | Project | | (Other) | |

| | |
|---|---|
| Grading and evaluating student work in class and at the final exam | 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). |

| Required literature (available in the library and via other media) | **Title** | **Number of copies in the library** | **Availability via other media** |
|---|---|---|---|
| | S. Duraković, S.Redžepović, Uvod u opću mikrobiologiju, Kugler, Zagreb, 2002. | 5 | |
| | S. Kalenić, E. Mlinarić-Missoni i sur., Medicinska bakteriologija i mikologija, Merkur A.B.D., Zagreb, 2005. | 5 | |
| | Z. Brudnjak, Medicinska virologija, Merkur A.B.D., Zagreb, 2002 | 5 | |

| | |
|---|---|
| Optional literature (at the time of submission of study programme | R.A. Harvey, P.C. Champe, B.D. Fisher, Microbiology, 2th ed., Lippincott, Williams and Wilkins, Philadelphia, 2007.<br>R.M. Patrick, S.R. Ken, A.P. Michael, Medical Microbiology, 5th ed. Elsevier/Mosby, Philadelphia, 2005. |

| | |
|---|---|
| proposal) | |
| 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) | |

# Water Technology

| **NAME OF THE COURSE** | **Water Technology** | | | | | |
|---|---|---|---|---|---|---|
| **Code** | KTD101 | Year of study | 1st | | | |
| Course teacher | PhD, Marina Trgo, prof. | Credits (ECTS) | 5.5 | | | |
| 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 | Students will introduce to procedures for the preparation of water used in the food industry, as well as associated wastewater treatment processes. | | | | | |
| Course enrolment requirements and entry competences required for the course | Passed exam in subject Analytical chemistry. | | | | | |
| Learning outcomes expected at the level of the course (4 to 10 learning outcomes) | After passing the exam the student is expected to know:<br>- Explain the processes for the preparation of drinking water used in the food industry<br>- Water quality requirements for different types of food industry<br>- Procedures for softening water<br>- Methods of test facilities biodegradable substances in water<br>- Conventional methods of wastewater treatment<br>- Advanced methods of wastewater treatment<br>- Basic regulations relating to water quality in the nature and maximum permissible concentrations of harmful substances in wastewater prior to discharge into the environment. | | | | | |
| Course content broken down in detail by weekly class schedule (syllabus) | 1st week: Hydrology. The water cycle, evaporation, infiltration, precipitation, underground and surface runoff. Condition of natural waters in Croatia. The division of water in nature.<br>2nd week: The water quality in Croatia, well-developed system of water supply and drainage. Preparation of drinking water. The use of water in the chemical and food industry.<br>3rd week: Physical and chemical properties of water. Indicators of water quality. Technological processes of water treatment. Filtration, membrane processes.<br>Seminar: Evaluation of water quality in the nature on the basis of chemical composition.<br>4th week: The application of membrane processes in the industry. Desalination. Adsorption. Adsorbents in water treatment technology. | | | | | |

| | | |
|---|---|---|
| | Seminar: Calculation of capacity of different adsorbents. Ion exchange, the possibilities of performances, calculation of ion exchange capacity.<br>5th week: Application of ion exchange processes in the preparation of process water. Seminar: Calculation of water hardness on the basis of chemical composition. The written knowledge tests.<br>6th week: The use of ion exchange in removal of heavy metal ions from water. Seminar: Design of ion exchanger, preparation of seminar works in the working groups.<br>7th week: Coagulation and Flocculation. Choosing a coagulant in the industry. The carbonate hardness. Water softening. Seminar: The calculation of precipitating agent dose, preparation of seminar works in the working groups.<br>8th week: Wastewater treatment. Selection methods and pathways for wastewater treatment. Seminar: preparation of seminar works in the working groups.<br>9th week: Biological treatment of wastewater. Aerobic and anaerobic treatment methods, design of bioreactors. Seminar: preparation of seminar works in the working groups. The written knowledge tests.<br>10th week: Phosphorus and nitrogen compounds in the treated effluent. Removal of nutrients from the water. Seminar: preparation of seminar works in the working groups.<br>11th week: Overview of advanced water purification process. Examples of multiple use of water in industry. Seminar: Oral presentation of the seminar works.<br>12th week: Examples of methods of wastewater treatment industry of alcoholic and non-alcoholic beverages. Seminar: Oral presentation of the seminar works.<br>13th week: Examples of methods of wastewater treatment industries of dairy products. Seminar: Oral presentation of the seminar works.<br>14th week: Examples of methods of wastewater treatment industry of meat and associated products. Field work - Visit the plant for the preparation of drinking water.<br>15th week: Field work - Visit the plant for sewage wastewater treatment. The written knowledge tests.<br>1st Laboratory exercise: Monitoring the process of adsorption of dissolved organic matter on the activated carbon by batch method using COD. Calculation of main process parameters.<br>2nd Laboratory exercise: Kinetic monitoring of biochemical degradation of organic matter using BOD. Calculation of the kinetic parameters.<br>3rd Laboratory exercise: Testing of coagulation and flocculation of colloidal particles dispersed in the aqueous solutions using jar test.<br>4th Laboratory exercise: Water softening using milk lime.<br>5th Laboratory exercise: Removal of total hardness of water neutral cation exchanger<br>6th Laboratory exercise: Removal of $Pb^{2+}$ using zeolite fixed bed method. Calculation of removal capacities in relation to the operating conditions. | |
| Format of instruction | x lectures<br>x seminars and workshops<br>x exercises<br>☐*on line* in entirety<br>☐partial e-learning | ☐ndependent assignments<br>x multimedia<br>x laboratory<br>☐work with mentor |

| | | | | | | |
|---|---|---|---|---|---|---|
| | x field work | | | ☐ (other) | | |
| Student responsibilities | | | | | | |
| 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 | 2.5 | Research | | Practical training | |
| | Experimental work | 2.0 | Report | 0.2 | Field work | 0.2 |
| | Essay | | Seminar essay | 0.3 | (Other) | |
| | Tests | 0.3 | Oral exam | 0.2 | (Other) | |
| | Written exam | 0.3 | Project | | (Other) | |
| Grading and evaluating student work in class and at the final exam | The requirement for admission to laboratory exercises is passed an oral colloquium for each exercise. Overall assessment can be applied over three written tests and one oral assessment. Written tests are related to material adopted in lectures, seminars, field work and laboratory exercises. The oral test is related to the presentation of the seminar work.<br>Ratings on the written exam and the written exams: 60-69% is sufficient, 70-79% good, 80-89% is very good, 90-100% excellent.<br>Students who have not passed the exam through the assessment should have the regular exam. Regular exam means written test and oral exam. The rating, which is entered in the index, is the mean score of written test, oral test and laboratory exercises. | | | | | |

| Required literature (available in the library and via other media) | **Title** | **Number of copies in the library** | **Availability via other media** |
|---|---|---|---|
| | D. Hendrics, Water Treatment Unit Processes, Taylor and Francis Group, Boca Raton, 2006. | | |
| | S. Tedeschi, Zaštita voda, HDGI, Zagreb, 1997. | | |
| | R.D. Noble, P.A. Terry, Principles of Chemical Separations with Environmental Applications, Cambridge University press, 2004. | | |
| | N.G. Wung Jern, Industrial Wastewater Treatment, Imperial College Press, London, 2006. | | |

| | |
|---|---|
| Optional literature (at the time of submission of study programme proposal) | F. N. Kemmer, Prijevod: I. Begovic, D. Vidić, Nalkov priručnik za vodu, Građevinska knjiga 2005. |
| Quality assurance methods that ensure the acquisition of exit competences | - Consultation with students<br>- Continuous writing assessment<br>- Results on the written knowledge tests<br>- Student's questionnaire. |
| Other (as the proposed wishes to add) | |

# Biotechnological Processes

| **NAME OF THE COURSE** | **Biotechnological Processes** |
|---|---|

| **Code** | KTD102 | Year of study | 1st | | | |
|---|---|---|---|---|---|---|
| Course teacher | PhD, Branka Andričić, prof. | Credits (ECTS) | 5.5 | | | |
| Associate teachers | PhD, Sanja Perinović Jozić, assistant prof. | 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 | Gaining of basic theoretical knowledge in biotechnology as well as the role and application of microorganisms and enzymes in industrial processes and environment protection. |
| Course enrolment requirements and entry competences required for the course | |
| Learning outcomes expected at the level of the course (4 to 10 learning outcomes) | - definition of term biotechnology<br>- differentiate the primary and secondary cell metabolism and its application in biotechnology<br>- explain of microbe cell growth diagram<br>- explain the advantages of isolated enzymes in biotechnology<br>- describe of basic bioreactor design<br>- describe the basic methods of intracellular products isolation<br>- outline some examples of biotechnological processes |
| Course content broken down in detail by weekly class schedule (syllabus) | 1st week: Description and overview of the course. Definitions of biotechnology, interdisciplinary of the field, history development, application areas.<br>2nd week: Perception of biotechnology in society. Metabolism and control of metabolic processes; primary and secondary metabolism, substrates.<br>3rd week: Anaerobic and aerobic metabolism. Microorganisms in biotechnology (bacterial, fungi (yeasts and moulds). Microbial growth kinetics. Determination of specific growth rate and Monod constant.<br>4th week: Enzyme technology (enzyme characteristics as the biocatalysts, advantages and disadvantages compared to whole cells). Enzyme kinetics.<br>5th week: Enzyme sources. Selection, production and immobilization of enzymes.<br>6th week: Biocatalysts in non-conventional processes. Bioreactors, photo-bioreactors, design.<br>7th week: Oxygen transfer and oxygen concentration determination. Heat transfer in bioreactor. An overview of the previous lecture for the test.<br>First test.<br>8th week: Extracellular, periplasmic and extracellular products of metabolism. Down-stream processing: separation solid-liquid, isolation of intracellular products.<br>9th week: Concentration and purification of products from bioreactor. Purification process control.<br>10th week: Process economy: cost estimation and an example of process design. An overview of biotechnological processes – basic scheme of biotechnological process.<br>11th week: Alcohol fermentation and its application in industry.<br>12th week: Lactic acid fermentation and its application in industry. Anaerobic biomass fermentation.<br>13th week: Biotechnology in pharmacy. Bacterial polymers.<br>14th week: Biotechnology in environmental protection and waste water treatment. |

<table>
<tr><td></td><td colspan="6">Biosensors.<br>15th week: An overview of the previous lectures. Second test.</td></tr>
<tr><td>Format of instruction</td><td colspan="3">X lectures<br>X seminars and workshops<br>☐exercises<br>☐on line in entirety<br>☐partial e-learning<br>☐field work</td><td colspan="3">☐independent assignments<br>X multimedia<br>X laboratory<br>☐work with mentor<br>☐ (other)</td></tr>
<tr><td>Student responsibilities</td><td colspan="6">Attendance on lectures at least 80 % and 100 % completed la 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>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>0.5</td><td>(Other)</td><td></td></tr>
<tr><td>Tests</td><td>0.8</td><td>Oral exam</td><td>0.8</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 colspan="5"></td></tr>
<tr><td>Grading and evaluating student work in class and at the final exam</td><td colspan="6">Attendance on lectures gains max 2 points, the exercises 10 and the seminar presentation 3 points. In the final grade that makes 30%. 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 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="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. C. Ratlege, B. Kristiansen, Eds. Basic Biotechnology, Cambridge University Press, Cambridge, 2006.</td><td>1</td><td colspan="2"></td></tr>
<tr><td colspan="3">2. A. Scragg, ed. Biotechnology for Engineers-Biological Systems in Technological Processes, Ellis Horwood LTD, Chichester, 1988.</td><td>1</td><td colspan="2"></td></tr>
<tr><td>Optional literature (at the time of submission of study programme proposal)</td><td colspan="6">J.E. Smith, Biotechnology, Cambridge University Press, Cambridge, 2000.</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>

# Fruit and Vegetable Processing

<table>
<tr><td colspan="2">NAME OF THE COURSE</td><td colspan="6">Fruit and Vegetable Processing</td></tr>
<tr><td>Code</td><td>KTD 105</td><td>Year of study</td><td colspan="5">1st</td></tr>
<tr><td>Course teacher</td><td>PhD, Tea Bilusic, prof.</td><td>Credits (ECTS)</td><td colspan="5">8.0</td></tr>
<tr><td rowspan="2">Associate teachers</td><td rowspan="2">PhD, Daniela Skroza, 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>45</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="5">35%</td></tr>
<tr><td colspan="7">COURSE DESCRIPTION</td></tr>
<tr><td>Course objectives</td><td colspan="6">- Understanding the maturation process in fruit and the choice of optimal conditions for fruit's storage<br>- Understanding of the influence of modified and controlled atmosphere on the fruit maturation process<br>- Understanding the enzymatic browning of fruit and its role in fruit spoilage<br>- Acquiring competitions in work with food storage and distribution (control of fruit maturation process, control of maintenace of product quality and product freshness<br>- Acquiring competitions in food processing plants (juices processing, production of pectin –derived products, processing of dry fruits…<br>- Acquiring knolwdge competition in work with vegetable products (canned and fermented vegetables, dry vegetables, processing of vegetable juices)</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 completing the course, the student will become familiarized with the major concepts of fruit and vegetables processing, which includes:<br>- the understanding of biochemical and physiological changes in fruit after maturation process<br>- the knoweldge on nutritive and healthy aspects of fresh fruits and vegetables and their products<br>- the understanding of the influence of paramteres related to fruit shelf-life and quality during storage<br>- the understanding of factors influencing the change of nutritive value and chemical composition of fruit during processing<br>- the knowledge on control systems for food safety in fruit and vegetables processing</td></tr>
<tr><td>Course content broken down in detail by weekly class schedule (syllabus)</td><td colspan="6">1. Fruit and vegetables classification. Healthy and nutritive aspects of fruit and vegetables.<br>2. The influence of maturation process on chemical composition and nutritive value of fruit.<br>3. Biologically active compounds from fruit and vegetables and their role in fruit and vegetable processing.<br>4. Microbiology of fresh and stored fruit and vegetable.<br>5. Physico-chemical changes in fruit during storage.<br>6. Post-harvest technology of fruit and vegetable.<br>7. Thermic treatments in fruit and vegetable processing.<br>8. Enhancement of nutritive value of fruits and vegetables after thermic treatments.</td></tr>
</table>

<table>
<tr><td></td><td colspan="6">9. Fruits and vegetables juices processing.<br>10. Pectin-based products.<br>11. Canned and fermented vegetables.<br>12. Dried fruits and vegetables.<br>13. Minimally processed fruits and vegetables.<br>14. Novel technologies in fruits and vegetables processing: vacuum technology, edible coating films, the use of high pressure, new modified atmosphere technology, the use of bioctechnology in fruits and vegetables processing.<br>15. Fruits and vegetables and their products characteristic for Dalmatian region.<br><u>Laboratory exercises:</u><br>- Determination of physical and chemical parameteres, the amount of pigments (carotenoids, anthocyanins) and biologically active compounds (total phenols, flavonoids) in fruits and vegetables after thermic treatments (blanching, cooking under high temperature)<br>- monitoring of physical and chemical parameters (water amount, amount of reducing sugars, pH, acidity) in fruits and vegetables during maturation process (climacteric and non-climacteric fruits)<br>- determination of carotenoids content in fruits during maturarion period<br>- pulpes of fruits preparation<br>- fruits juices processing<br>- fruits clarification<br>- vegetables juices processing<br>- preparation of fruit compotes<br>- preparation of minimally processed fruits and vegetables<br>- fermented vegetables (sauerkraut)<br>- pectin-based products preparation: jam, jellies<br>dried fruits and vegetables preparation</td></tr>
<tr><td>Format of instruction</td><td colspan="3">☒lectures<br>☒seminars and workshops<br>☐exercises<br>☐on line in entirety<br>☐partial e-learning<br>☐field work</td><td colspan="3">☐independent assignments<br>☒multimedia<br>☒laboratory<br>☐work with mentor<br>☐(other)</td></tr>
<tr><td>Studentresponsibilities</td><td colspan="6">Lectures attendance - at least 70% of full schedule; attendance on seminar work – at least 80% of full schedule. To design the seminar work on selected topic</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></td><td>Practical training</td><td></td></tr>
<tr><td>Experimental work</td><td>1</td><td>Report</td><td>1</td><td>Activity during course</td><td>1</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>1</td><td>Oral exam</td><td>2</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></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 semester, two written exams are provided (as partical examinations). Test will be carried out within 60 minutes. Students who obtain positive mark from both exams, will have oral examination in order to obtain the final mark. During semester, students should present their seminar work on selected topic within this course. The final mark of this course will count the mark from seminar work, marks from written exams, and mark from oral exams.</td></tr>
</table>

| | Title | Number of copies in the library | Availability via other media |
|---|---|---|---|
| Required literature (available in the library and via other media) | L. De la Rosa, E. Alvarez-Parilla, G. Gonzalez-Aguilar: Fruit and Vegetable Phytochemicals, Wiley-Blackwell, 2010 | | x |
| | W. Jongen: Fruit and Vegetable Processing-Improving Quality, CRC, 2002 | | x |
| | Y.H. Hui et al. Handbook of Fruits and Fruit Processing, Blackwell Publishing, 2006 | | x |
| | N.K. Sinha et al. Handbook of Vegetables and Vetegable Processing, Blackwell, 2005 | | |
| | V. Katalinić, I. Generalić, D. Skroza: Tehnologija mediteranskog voća i povrća, skripta za laboratorijske vježbe, KTF, 2010. | | KTF web page |
| Optional literature (at the time of submission of study programme proposal) | P.R. Ashurst: Chemistry and Technology of Soft Drinks and Fruit Juices, Blackwell, 2005; W.V. Cruess: Laboratory Manual of Fruit and Vegetable Products, General Book, 2010. | | |
| Quality assurance methods that ensure the acquisition of exit competences | • registration of student's presence in class<br>• annual analysis of students success in this course<br>• student's survey in order to evaluate the professor<br>• professor's self-evaluation | | |
| 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 | 1st | | | |
| Course teacher | PhD, Igor Jerković, prof. | Credits (ECTS) | 6.5 | | | |
| 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 | 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 | After passing the course, students will be able to:<br>• describe the basic concepts, essential oils, aromatic plants processing | | | | | |

| | |
|---|---|
| (4 to 10 learning outcomes) | procedures, analyses of isolates obtained and typical use of essential oils<br>• illustrate the ways of smell perception, the biosynthesis of terpenes and other compounds of essential oils, the basic division of terpenes<br>• demonstrate basic procedures in the processing of aromatic plants, simple method for isolation of essential oils and aromatic extracts preparation<br>• determine the appropriate method of analysis of derived isolates (basic physical and chemical values, the application of chromatographic and spectroscopic methods)<br>• 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<br>• 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).<br><br>**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); biogenesis semiterpenes, acyclic and cyclic mono-and sesquiterpenes. (3 hours)<br><br>**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)<br><br>**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) |

<table>
<tr><td></td><td colspan="6">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<br>X seminars and workshops<br>X exercises<br>☐on line in entirety<br>☐partial e-learning<br>☐field work</td><td colspan="3">☐independent assignments<br>☐multimedia<br>☐laboratory<br>☐work with mentor<br>☐(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>
<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">K. H. Basser, G. Buchbauer, Handbook of Essential Oils: Science, Technology and Application, CRC Press, 2010</td><td>1</td><td>no</td></tr>
<tr><td colspan="3">E. Guenther, The Essential Oils, vol. I: History – Origin in Plants – Production – Analysis, Jepson Press, 2008</td><td>1</td><td>no</td></tr>
<tr><td colspan="3">Igor Jerković, Predlošci za predavanja iz Kemije i tehnologije aromatičnog bilja, KTF, 2014.</td><td>0</td><td>yes (web page KTF)</td></tr>
<tr><td>Optional literature (at the time of submission of study programme proposal)</td><td colspan="6">R. P. Adams, Identification of essential oils by gas chromatography/mass spectrometry, Allured Publishing Corporation, 2007<br>E. Guenther, The Essential Oils, vol. II-VI, van Nostrand Co, Princeton, 1964.</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>
</table>

| | |
|---|---|
| Other (as the proposer wishes to add) | |

# Grape Processing

| NAME OF THE COURSE | Grape Processing | | | | | |
|---|---|---|---|---|---|---|
| **Code** | KTD201 | Year of study | 2nd | | | |
| Course teacher | PhD, Ivana Generalić Mekinić, assistant prof. | Credits (ECTS) | 8.0 | | | |
| Associate teachers | | Type of instruction (number of hours) | L | S | E | F |
| | | | 45 | 15 | 30 | 0 |
| Status of the course | Mandatory | Percentage of application of e-learning | | | | |
| **COURSE DESCRIPTION** | | | | | | |
| Course objectives | Enable students to gain basic knowledge on grapes as the raw material for whole spectrum of products, main wine production methods, specific operations in the production of red, white and rose wines, factors affecting the quality of raw material and final product, as well as respective legal limitations. | | | | | |
| 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 this course, student will be able to:<br>- understand the potential of grapes as raw-material and define the main grape products<br>- define the grape structure and most major chemical constituents of grapes and wines<br>- define main steps of the vinification process and distinguish the red and white wine production process specificities<br>- understand the role of ordinary prefermentation and post-fermentation operations<br>- define and understand the importance of alcohol and malolactic fermentation<br>- define role of sulfur dioxide in wine making as well as legal limitations of its use<br>understand the importance of disposal and possible reuse of the vinification by-products | | | | | |
| Course content broken down in detail by weekly class schedule (syllabus) | 1st week: Grapes- raw material and product; Global trends in grape production and processing;<br>2nd week: Mechanical and chemical composition of grapes;<br>3rd week: Wine cellar equipment, organization and sanitation;<br>4th week: Grape maturity and harvest; Grape must processing; Prefermentative procedures; Yeasts in winemaking<br>5th week: Alcoholic fermentation biochemistry and kinetic; Primary alcohol fermentation; secondary malolactic fermentation); Acetic bacteria.<br>6th week: Wine fermentation (; Specificities of winemaking processes for white, red and rose wines;<br>7th week: I. Colloquium;<br>8th week: Wine chemical composition; Physical and chemical stability of wines (tartrate, protein and colloidal stability)<br>9th week: The use of sulphur in winemaking;<br>10th week: The use of enzyms in winemaking;<br>11th week: Postfermentation processes (stabilization, fining, filtration, maturation, bottling) | | | | | |

<table>
<tr><td></td><td colspan="6">12th week: Wine desease and wine deterioration;<br>13th week: Sparkling wine technology; Special and barrique wines; Quality control and recommended analysis (panels); Laws and regulations in wine production;<br>14th week: Technology of distilled spirits; Grape seed oil; Pigments; Grape antioxidants; By-products of vinification from the economic and ecological point of view.<br>15th week: II. Colloquium.</td></tr>
<tr><td>Format of instruction</td><td colspan="3">x lectures<br>x seminars and workshops<br>x exercises<br>☐on linein entirety<br>☐partial e-learning<br>x field work</td><td colspan="3">☐ndependent assignments<br>x multimedia<br>x laboratory<br>☐work with mentor<br>☐ (other)</td></tr>
<tr><td>Studentresponsibilities</td><td colspan="6">Admission to the lectures and seminars of at least 70% of the times scheduled. Students are required to attend laboratory practice and field work 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>1,0</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>(Other)</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></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 course content is divided into three 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; 60-70% successful (2) 70-80% good (3), 80-90% very good (4), 90-100% excellent (5).</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 colspan="2">Availability via other media</td></tr>
<tr><td colspan="3">P. Riberau-Gayon et.al. Handbook of enology Vol 1Vol 2; John Wiley&Sons, Ltd., Chichester, 2006.</td><td></td><td colspan="2">Yes</td></tr>
<tr><td colspan="3">R.S. Jackson, Wine Science, Academic Press, New York, 2000.</td><td></td><td colspan="2">Yes</td></tr>
<tr><td colspan="3">J.L. Jackobson, Introduction in wine laboratory practices and procedures, Springer, New York, 2006.</td><td></td><td colspan="2">Yes</td></tr>
<tr><td colspan="3">R.B. Boulton et al., Principles and practices of winemaking, New York, Chapman/Hall, 1996.</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">B.W. Zoecklein, K.C. Fugelsang, B.H. Gump, F.S. Nurs, Wine analysis and production, Kluwer Ac./Plenum Pubishers, New York, 1995.<br>M.A. Amerine, C.S. Ougs, Methods for analysis of musts and wines, John Wiley&Sons, 2000.<br>R.P. Vine, Winemaking: Form grape growing to market place, Springer, New York, 2002.<br>M.A. Amerine; H.W. Berg, R.E. Kunkee, C.S. Ough, V.L. Singleton, A.D. Webb, Technology of winemaking, Avi Publishing Co., Westport, Connecticut, 1980.<br>K.C. Fugelsang, Wine microbiology, New York, ChapmanHall, 1997.</td></tr>
<tr><td>Quality assurance methods that ensure the acquisition of exit</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>
</table>

| | |
|---|---|
| competences | |
| Other (as the proposer wishes to add) | |

# Processing of Olives

| **NAME OF THE COURSE** | **Processing of Olives** | | | | | |
|---|---|---|---|---|---|---|
| **Code** | KTD215 | Year of study | 2nd | | | |
| Course teacher | PhD, Ivica Ljubenkov, assistant prof. | Credits (ECTS) | 7.0 | | | |
| Associate teachers | | Type of instruction (number of hours) | L | S | E | F |
| | | | 45 | | 30 | |
| Status of the course | Mandatory | Percentage of application of e-learning | | | | |

| **COURSE DESCRIPTION** | | |
|---|---|---|
| Course objectives | Students will acquire the basic practical knowledge on the production of olives and their processing in olive oil and table olives. | |
| 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 the student is able to:<br><br>- Demonstrate the basic steps in making olive oil and table olives production,<br>- Independently perform basic tests of olive oil and table olives quality evaluation,<br>- Know the basic legislation in the field of olive oil and table olives.<br>- Choose the correct approach in solving the problems with waste materials from olive oil and table olives production, | |
| Course content broken down in detail by weekly class schedule (syllabus) | 1st week: Introduction to olive processing<br>2nd week: Chemical, physic and morphometric characteristics of major olive cultivars<br>3rd week: Parameters affecting the quality of olive oil and table olives<br>4th week: Quality of olive oil and table olives<br>5th week: Legislation in the field of olive oils and table olives<br>6th week: Optimal technological maturity of olives<br>7th week: I. Colloquium<br>8th week: Harvesting<br>9th week: Storage<br>10th week: Processing methods for olive oils<br>11th week: Processing methods for table olives<br>12th week: Storage of olive oils and table olives<br>13th week: Processing and packaging<br>14th week: Waste materials from the production of olive oil and table olives: economic and ecological point of view<br>15th week: II. Colloquium | |
| Format of instruction | **x** lectures<br>☐seminars and workshops<br>**x** exercises<br>☐*on line* in entirety<br>☐partial e-learning<br>**x** field work | ☐independent assignments<br>**x** multimedia<br>**x** laboratory<br>☐work with mentor<br>☐ (other) |

<table>
<tr><td>Studentresponsibilities</td><td colspan="6">Admission to the lectures and seminars of at least 70% of the times scheduled. Students are required to attend laboratory practice and field work 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>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>3,5</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 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 three 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; 60-70% successful (2) 70-80% good (3), 80-90% very good (4), 90-100% excellent (5).</td></tr>
<tr><td rowspan="8">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">D. Boskou, Olive Oil-Chemistry and Technology, AOCS press, Champaign, Illinois, 1996, ISBN 0-935315-73-X.</td><td></td><td colspan="2">1</td></tr>
<tr><td colspan="3">Maslina i maslinovo ulje A-Ž, (Zadro, B. i Perica, S., ur.), Naklada Zadro, Zagreb, 2007, ISBN 978-953-182-075-2.</td><td></td><td colspan="2">1</td></tr>
<tr><td colspan="3">O. Koprivnjak, Djevičansko maslinovo ulje: od masline do stola, MIH, Poreč, 2006, ISBN 953-95365-2-9.</td><td></td><td colspan="2">1</td></tr>
<tr><td colspan="3">B. Škarica i sur., Maslina i maslinovo ulje visoke kakvoće u Hrvatskoj, Mario Bonifačić, Punat, 1996.</td><td></td><td colspan="2">1</td></tr>
<tr><td colspan="3">S. Kailis i D. Harris, Producing Table Olives, Landlink Press, Collingwood, 2007. ISBN: 9780643092037</td><td></td><td colspan="2">1</td></tr>
<tr><td colspan="3">S. Bulimbašić, Proizvodnja maslinovog ulja i konzerviranje masline, Mediteranska poljoprivredna knjiga, 2013</td><td>2</td><td colspan="2"></td></tr>
<tr><td colspan="6"></td></tr>
<tr><td>Optional literature (at the time of submission of study programme proposal)</td><td colspan="6">B.W. Zoecklein, K.C. Fugelsang, B.H. Gump, F.S. Nurs, Wine analysis and production, Kluwer Ac./Plenum Pubishers, New York, 1995.<br>M.A. Amerine, C.S. Ougs, Methods for analysis of musts and wines, John Wiley&Sons, 2000.<br>R.P. Vine, Winemaking: Form grape growing to market place, Springer, New York, 2002.<br>M.A. Amerine; H.W. Berg, R.E. Kunkee, C.S. Ough, V.L. Singleton, A.D. Webb, Technology of winemaking, Avi Publishing Co., Westport, Connecticut, 1980.<br>K.C. Fugelsang, Wine microbiology, New York, ChapmanHall, 1997.</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>

# Quality Assurance of Food

| NAME OF THE COURSE | Quality Assurance of Food | | | | | |
|---|---|---|---|---|---|---|
| **Code** | KTD 203 | Year of study | 2nd | | | |
| Course teacher | PhD, Josipa Giljanović, associate prof. | Credits (ECTS) | 4.0 | | | |
| Associate teachers | | Type of instruction (number of hours) | L | S | E | F |
| | | | 30 | 0 | 30 | 0 |
| Status of the course | Mandatory | Percentage of application of e-learning | 15% | | | |

| COURSE DESCRIPTION | |
|---|---|
| Course objectives | Acquiring a basic and practical knowledge on principles, methodology, techniques of quollity assurance on food in RH and EU |
| Course enrolment requirements and entry competences required for the course | Completed appropriate undergraduate study and course Hygiene and sanitation and Processes in food industry |
| Learning outcomes expected at the level of the course (4 to 10 learning outcomes) | After the course, student will be able to:<br>- Make a label and chose appropriate method for determiniation some of the basic ingredients in food<br>- Define, plan and implement chosen method,<br>-calculate and interpret the results<br>- Compare chosen methods with similar methods and evaluate methods<br>- Estimate if methods is suitable for other purposes,<br>- Write an analytical report<br>- Understand the role, development and implementation of quality management systems in the process and laboratory<br>- Understand the role of standards and standardization |
| Course content broken down in detail by weekly class schedule (syllabus) | 1. Week: Introduction to Food Analysis, Sampling and sample preparation.<br>2. Week: Determination of basic food ingredients: water, methods for the determination of water, ash mineral matter, methods of determination<br>3. Week:. determination of protein, methods for determination of protein nitrogen and<br>4. Week:. determination of fats; division, the assay method,<br>5. Week:. determination of carbohydrates; division, methods of determination.<br>6. Week: determination of vitamins, a division of methods of determination. Assessment<br>7. Week : 1st. partial exam, solving the test<br>8. Weeks: Work organization testing laboratories, introduction and basic concepts; basic quality system; criteria for accreditation of testing laboratory<br>9. Week: good laboratory practice, requirements and documentation<br>10. Week: ISO 9001, ISO 22000,<br>11. Week: The system of authorization and accreditation in Europe and Croatia, principles and rules. The requirements of EN ISO / IEC 17025 standard.<br>12. Week: validation of methods, basic concepts and definitions,<br>13. Week: recall and withdrawal records<br>14. Week: validation of methods, requirements, planning, performance and documentation, validation parameters.<br>15. Week: 2st. partial exam, solving the test<br><br>Laboratory exercises:<br>1. Determine of water in food.;<br>2. Determination ash and minerals in food; |

| | | | | | | |
|---|---|---|---|---|---|---|
| | 3. Kleldahl methods;<br>4 Determination of fat;<br>5. Determination of carbohydrates;<br>6th Determination vitamina- UV / VIS spectroscopy;<br>7. Determination of metals contents in foood, AAS<br>8. IR spectroscopy,<br>9. Potentiometric determination of chloride in food | | | | | |
| Format of instruction | ⊠ lectures<br>⊠ seminars and workshops<br>⊠ exercises<br>□ *on line*in entirety<br>⊠ partial e-learning<br>□field work | | □independent assignments<br>⊠ multimedia<br>□laboratory<br>□work with mentor<br>□ (other) | | | |
| Studentresponsibilities | Lectures attendance - at least 80% and completing seminars | | | | | |
| 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 | | Laboratory Exercisses | 1,0 |
| | Experimental work | | Report | | (Other) | |
| | Essay | | Seminar essay | | (Other) | |
| | Tests | 0,5 | Oral exam | 0,5 | (Other) | |
| | Written exam | 0,5 | Project | 1,0 | (Other) | |
| Grading and evaluating student work in class and at the final exam | 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%.<br>Rating: 60% -69% - satisfactory, 70% -79% - good, 80% -89% very good, 90% - 100% - excellent. | | | | | |

| Required literature (available in the library and via other media) | **Title** | **Number of copies in the library** | **Availability via other media** |
|---|---|---|---|
| | 1.Pravilnici o metodama uzimanja uzoraka i metodama obavljanja kemijskih i fizikalnih analiza različitih prehrambenih proizvoda; | 3 | 2. web-pageof the department and www.foodlinks.eu |
| | 2. J. Giljanović, Predavanja, interni materijal, Split, 2014.g.<br>. | | |
| | 3J. Giljanović, Uputstva za vježbe, interni materijal, Split, 2014. | | |
| | 4. Opći zahtjevi za osposobljenost ispitnih i umjernih laboratorija (ISO/IEC 17025:2005+Cor.1:2006; EN ISO/IEC 17025:2005+AC:2006); General requirements for the competence of testing and | | |

| | | | |
|---|---|---|---|
| | calibration laboratories (ISO/IEC 17025:2005+Cor.1:2006; EN ISO/IEC 17025:2005+AC:2006) | | |
| | 5. M.Kaštelan-Macan, Kemijska analiza u sustavu kvalitete, Školska knjiga, Zagreb (2003), | | |
| Optional literature (at the time of submission of study programme proposal) | 1.Suzanne Nielsen,; Food Analysisi, fourth edition, S.S., Springer Science+Business Media, LLC, New York, NY, USA, 2010.<br>2. Ceirwyne S. james, Analytical chemistry of food, Aspen publisher, Inc.Gaithesburg, Maryland, 1999;.<br>3. Official Methods of Analysis of AOAC International, 19th Ed. 2012. Editor: Dr. George W. Latimer, Jr<br>4.Prijevod: General Principles of Food Hygiene CAC/RCP 1-1969, Rev. 4-2003 2/29, JCodex Alimentarius-Joint FAO/WHO Food Standards, ISO, IDF, IUPAC, ICC - standardi za pojedine vrste namirnica, | | |
| Quality assurance methods that ensure the acquisition of exit competences | • registration of student's presence in class<br>• annual analysis of students success in this course<br>• student's survey in order to evaluate the professor<br>• professor's self-evaluation | | |
| Other (as the proposer wishes to add) | | | |

# Citrus Processing

| **NAME OF THE COURSE** | **Citrus Processing** | | | | | |
|---|---|---|---|---|---|---|
| **Code** | KTD204 | Year of study | 2nd | | | |
| Course teacher | PhD, Ivana Generalić Mekinić, assistant prof. | Credits (ECTS) | 4.0 | | | |
| Associate teachers | | Type of instruction (number of hours) | L | S | E | F |
| | | | 30 | | 15 | |
| Status of the course | Elective | Percentage of application of e-learning | | | | |
| **COURSE DESCRIPTION** | | | | | | |
| Course objectives | Student will acquire the basic practical knowledge on citrus fruits, their nutritive value, processing technologies and know main citrus products | | | | | |
| 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 the student will:<br><br>- know main characteritics of citus fruits (taxonomy, morphology and physiology)<br>- be able to demonstrate basic steps in citrus juice processing<br>- know chemical composion and properties of citrus essential oils and ways of their production<br>- know some other citrus products and basic steps in their production and by-products | | | | | |
| Course content broken down in detail by weekly class schedule | 1st week: Citrus: origin and history<br>2nd week: Development of the citrus industry<br>3rd week: Citrus fruits: chemical composition and properties<br>4th week: Citrus processing | | | | | |

<table>
<tr><td>(syllabus)</td><td colspan="6">5th week: Citrus juices technology. Standards (Codex)<br>6th week: Steps and procedures in the production of citrus juices. Chemical reactions in the juice production<br>7th week: I. Colloquium<br>8th week: Other citrus products<br>9th week: Nutritive value of the citrus fruits<br>10th week: Citrus essential oil production<br>11th week: Citrus by-products<br>12th week: Quality control. Legislation<br>13th week: Characterisation of the citrus essential oils by HPLC-MS<br>14th week: Present and future application of citrus essential oils. Therapeutic prperties of citrus essential oils<br>15th week: II. Colloquium</td></tr>
<tr><td>Format of instruction</td><td colspan="3">x lectures<br>☐seminars and workshops<br>x exercises<br>☐on linein entirety<br>☐partial e-learning<br>☐field work</td><td colspan="3">☐ndependent assignments<br>x multimedia<br>x laboratory<br>☐work with mentor<br>☐ (other)</td></tr>
<tr><td>Studentresponsibilities</td><td colspan="6">Admission to the lectures and seminars of at least 70% of the times scheduled. Students are required to attend laboratory practice and field work 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>0,5</td><td>Research</td><td></td><td>Practical training</td><td>0,5</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>3,0</td><td>Oral exam</td><td>(1,5)</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></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 course content is divided into three 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; 60-70% successful (2) 70-80% good (3), 80-90% very good (4), 90-100% excellent (5).</td></tr>
<tr><td rowspan="6">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">G. Dugo and A. Di Giacomo, Citrus The genus citrus, Taylor&Francis, London, 2002</td><td></td><td colspan="2">Yes</td></tr>
<tr><td colspan="3">D. A. Kimball, Citrus processing. A complete quide, Sec. ed. C.H.I.P.S., 1999</td><td></td><td colspan="2">Yes</td></tr>
<tr><td colspan="3">A. Di Giacomo,and B. Mincione, Gli olii essenziali agrumari in Italia, baruffa editore (Reggio Calabria)1994</td><td></td><td colspan="2">Yes</td></tr>
<tr><td colspan="3">D.M. Barrett, L.P. Somogyi, H.S. Ramaswamy, Processing Fruits: Science and Technology, Sec. Ed., CRC Press, Basel, 2004</td><td></td><td colspan="2">Yes</td></tr>
<tr><td colspan="3">W. Jongeng, Processing fruits: Science and technology, Vol. 1. and Vol. 2., Technomic, Basel,</td><td></td><td colspan="2">Yes</td></tr>
</table>

| | | | |
|---|---|---|---|
| | 1996. | | |
| Optional literature (at the time of submission of study programme proposal) | P.R. Ashort, Chemistry and technology of soft drinks and fruit juices, Chipsbooks, 1998.<br>G.A. Tucker, L.F.J. Woods, Enzymes in food processing, AVI Publishing Company, New York, 1991.<br>T. W. Goodwin, Plant pigments, Academic Press Limited, London, 1998.<br>S. Nagy, C.S. Chen, P.E. Shaw, Fruit juice processing and technology, Auburndale, Florida, 1993. | | |
| 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) | | | |

# Mediterranean Diet

<table>
<tr><td colspan="2">NAME OF THE COURSE</td><td colspan="6">Mediterranean Diet</td></tr>
<tr><td>Code</td><td>KTD 205</td><td>Year of study</td><td colspan="5">2nd</td></tr>
<tr><td>Course teacher</td><td>PhD, Tea Bilusic, prof.</td><td>Credits (ECTS)</td><td colspan="5">4.0</td></tr>
<tr><td rowspan="2">Associate teachers</td><td rowspan="2">Tonča Koludrović, 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></td><td>15</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">35%</td></tr>
<tr><td colspan="7">COURSE DESCRIPTION</td></tr>
<tr><td>Course objectives</td><td colspan="6">- Knowledge in the role of macro- and micronutrients from food<br>- Understanding the calucation of daily energy requirements for targeted populations<br>- Knowledge in principle of healthy diet<br>- Understanding the main features of traditional Mediterranean Diet and its role in chronic diseases prevention<br>- Knowledge in main bioactive components present in Mediterranean Diet<br>- Acquiring competition in creation of healthy diet regime<br>- Acquirinig competition in determination of nutritive status<br>- Acquiring competition in calucation of daily calory intake</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">- Acquiring knowledge in main characteristics of Mediterraean Diet<br>- Understanding the mechanisms of bioactive food components in human body homeostasis<br>- Acquiring knowledge in factors affecting nutritive status<br>- Understanding the role of Mediterranean Diet in various chronic diseases<br>- Understanding the effect of diet on the incidence for chronic diseases development (the epigenetic role)<br>- Understanding the beneficial role of Mediterranean Diet in prevention of malignant diseases</td></tr>
<tr><td>Course content broken down in detail by weekly class schedule (syllabus)</td><td colspan="6">Macronutrients from food (the most important facts on the role of carbohydrates, proteins and lipids and their sources in Mediterranean Diet) 3 hours<br>Micronutrients (vitamins and minerals) from foods characteristic in Mediterranean Diet 2 hours<br>Principles of healthy diet regime – link with the Mediterranean Diet pyramide 2 hours<br>Plant and animal derived foods characteristic for Mediterranean Diet 4 hours<br>Functional food in Mediterranean Diet 2 hours<br>The role of aromatic and medicinal plants (and spices) in Mediterranean Diet 2 hours<br>The role of epigenetic in diet (proofs linked with Mediterranean Diet) 2 hours<br>Mediterranean Diet and ageing process 2 hours<br>Mediterranean Diet and human homeostasis 2 hours<br>Mediterranean Diet in prevention of chronic diseases (diabetes type 2, coronary</td></tr>
</table>

<table>
<tr><td></td><td colspan="6">heart diseases, cancers, osteoporosis, obesity) 9 hours<br>Exercises:<br>- Determination of the percentage of lipids in the body using caliper and the instrument with automatic reading (Omron)<br>- Assembling the 24-h inquiry and the classification of obtained results<br>- Calculation of body mass index, the percenteage of nutritional status<br>- Assembling the daily and weekly menu based on the principles of Mediterranean Diet<br>- Calculation of daily calory intake for targeted populations</td></tr>
<tr><td>Format of instruction</td><td colspan="3">☒lectures<br>☐seminars and workshops<br>☒exercises<br>☐*on line* in entirety<br>☐partial e-learning<br>☐field work</td><td colspan="3">☐independent assignments<br>☒multimedia<br>☐laboratory<br>☐work with mentor<br>☐(other)</td></tr>
<tr><td>Student responsibilities</td><td colspan="6">Lectures attendance - at least 70% of full schedule; attendance on experimental work – 100% of full schedule.</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</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>Activity during course</td><td>1</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>0.5</td><td>Oral exam</td><td>2</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>Grading and evaluating student work in class and at the final exam</td><td colspan="6">During semester, two written exams are provided (as partical examinations). Test will be carried out within 60 minutes. Students who obtain positive mark from both exams, will have oral examination in order to obtain the final mark. During semester, students should present their seminar work on selected topic within this course. The final mark of this course will count the mark from seminar work, marks from written exams, and mark from oral exams.</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 colspan="2">Availability via other media</td></tr>
<tr><td colspan="3">T. Bilušić: Dijetetika, revised power point presentation, 2013, KTF</td><td></td><td colspan="2">KTF web page</td></tr>
<tr><td colspan="3">T. Bilušić: Osnove znanosti o hrani, revised power point presentation, 2013, KTF</td><td></td><td colspan="2">KTF web page</td></tr>
<tr><td colspan="3">V. Katalinić: Temeljno znanje o prehrani, manual, 2011, KTF</td><td></td><td colspan="2">KTF web page</td></tr>
<tr><td colspan="3">G. Krešić: Trendovi u prehrani, , Fakultet za menadžment u ugostiteljstvu i turizmu, Opatija, 2012.</td><td>X</td><td colspan="2"></td></tr>
<tr><td>Optional literature (at the time of submission of study programme proposal)</td><td colspan="6">R. Živković: Dijetetika, Medicinska naklada, Zagreb, 2002.<br>J. S. Garrow, W.P.T. James: Human nutrition and dietetics. 10th Edition, Churchill Livingostone, Co. London, 2000.</td></tr>
</table>

| | |
|---|---|
| Quality assurance methods that ensure the acquisition of exit competences | • registration of student's presence in class<br>• annual analysis of students success in this course<br>• student's survey in order to evaluate the professor<br>• professor's self-evaluation |
| Other (as the proposer wishes to add) | |

# Seafood processing and quality assurance

| NAME OF THE COURSE | Seafood processing and quality assurance | | | | | |
|---|---|---|---|---|---|---|
| Code | KTD217 | Year of study | 2nd | | | |
| Course teacher | PhD, Vida Šimat, assistant prof. | Credits (ECTS) | 4.0 | | | |
| Associate teachers | | Type of instruction (number of hours) | L | S | E | F |
| | | | 30 | 0 | 0 | 15 |
| Status of the course | Elective | Percentage of application of e-learning | | | | |

| COURSE DESCRIPTION | |
|---|---|
| Course objectives | - Enabling students to implement knowledge of post mortal processes taking place in fish meat and viscera during different storage and handling conditions.<br>- Gaining knowledge of the impact that post-mortal changes and handling processes have on fish quality important during both further industrial processing and human consumption.<br>- Gaining knowledge of conservation technologies (cooling, freezing, canning, salting, marinating, smoking and drying) used for fish and other raw materials originated from sea. |
| Course enrolment requirements and entry competences required for the course | Competence in applying knowledge of chemistry, biochemistry, biology and microbiology. |
| Learning outcomes expected at the level of the course (4 to 10 learning outcomes) | Learning outcomes:<br><br>- Knowledge of post-mortal changes in fish and implementation of this knowledge in product conservation.<br>- Knowledge of principals for different methods of fish conservation and ability to applying this knowledge.<br>- Knowledge of quality assessment methods used in different production stages (raw materials, technology processes and final products) in fish processing industry, using information about different fish species, seasonal changes, conservation methods and the changes that take place during processing.<br>- Knowledge of quality parameters for fishery products and evaluation of shelf-life, along with their assessment using sensory, microbiological, biochemical and chemical methods.<br>- Knowledge of quality management in fish processing industry. |
| Course content broken down in detail by weekly | 1st week: Structure and composition of fish and edible portion of fish meat. Introduction. Fish processing industry today. Fish species used for human consumption. Structure and chemical composition of fish muscle. Commercial value |

| | | |
|---|---|---|
| class schedule (syllabus) | and nutritive composition of fish. Characteristics of fish as raw material. Rational fish processing - maximum yield utilization of raw material. (2 hours)<br><br>2nd week: Post-mortem changes in stored fish<br>Differentiation and identification of physical, biochemical and microbiological post-mortal changes which lead to spoilage. (3 hours)<br><br>3rd week: Raw material and final product spoilage. Conservation processes. Raw material quality assessment. Spoilage rates and control. Role of cold distribution chain. (2 hours)<br><br>4th week: Ice in marine fisheries. Ice production. Handling catch on fish vessels. Methods of transportation and handling of fish on mainland. Cooling processes: air, cool seawater and super-chilling to -2°C. Changes during chilling of biological material. (3 hours)<br><br>5th week: Preservation of fish using low temperatures. Protection of frozen fish. Proper defrosting procedures. Principles of transport and appropriate distribution of frozen fishery products. (3 hours)<br><br>6th week: Preservation of fish at high temperatures. Canned fish production. (2 hours)<br><br>7th week: Preservation of fish by drying. Principles of preservation by drying. Natural and artificial drying. Preservation of fish by smoking. Principles of preservation by smoking. Function, characteristics and composition of smoke. (2 hours)<br><br>8th week: Preservation of fish by marinating. Principles of preservation by marinating. Cold and warm marinades. Preservation of fish by salting. Marinating and salting facilities. Hazards/risks during the production of thermally non-treated products. (2 hours)<br><br>9th week: Preservation of fish gonads. Processing of invertebrates. Algae products. Production of fish oils and fish meal, vitamins and fish-originated products, used by other industries. (2 hours)<br><br>10th week: Packaging materials and methods used in seafood industry. Allowed additives, declarations and labelling. (2 hours)<br><br>11th week: Quality management. Production control, quality management and traceability in the fish processing industry. Quality management and responsible waste/waste water management in seafood industry. Legal responsibilities of food-producing business subjects. Prerequisite programme. (4 hours)<br><br>12th week: HACCP system in the fish processing industry. National and EU legislation related to seafood production and safety. Implementation and application of HACCP plan. Getting to know the "Codex alimentarius" hygienic package and rules for fish processing industry and certain technological procedures, responsibilities of food industry. (2 hours)<br><br>Exercises (filed work). | |
| Format of instruction | √ lectures<br>☐ seminars and workshops<br>☐exercises<br>☐*on line* in entirety<br>☐partial e-learning<br>√ field work | √ independent assignments<br>☐multimedia<br>☐laboratory<br>☐work with mentor<br>☐ (other) |
| Student | Students are required to attend classes (lectures and exercises), to actively | |

<table>
<tr><td>responsibilities</td><td colspan="6">participate in the teaching process and pass the exam (colloquiums). The presence in the classroom will be recorded (lectures and exercises). A student is allowed one unexcused absence from exercises and two absences from lectures. Field exercises are obligatory. The omission is justified in the case of certain activities at the University for which it is necessary to have a written confirmation. Delay in classes (lectures and exercises) will also be recorded; three delays will be counted as one unexcused absence. 100% presence in the class will be rewarded with two points at the colloquium.</td></tr>
<tr><td rowspan="7">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></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</td><td>(Other)</td><td></td></tr>
<tr><td>Tests (3)</td><td>1</td><td>Oral exam</td><td></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">* Three partial tests can be replaced by a final written exam.</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 three units. For each unit students write a partial test, 25 points each. One test is considered passed if student achieves at least 50%. At the end of the semester, as a final exam, the students present their seminar essay (25 points) which encompasses the whole course content (see Essay section). Each student will be given the Seminar essay task at the beginning of the semester; the students are expected to use available scientific literature for this task. The final grade is based on the total number of points gained from three partial tests and seminar essay: Grades: <50% failed; 50-64% successful (2) 65-75% good (3), 76-89% very good (4), >90 excellent (5).</td></tr>
<tr><td rowspan="8">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">Šoša B. (1989). Higijena i tehnologija prerade morske ribe, Školska knjiga, Zagreb.</td><td></td><td>1</td></tr>
<tr><td colspan="3">Sikorski ZE. (1990). Seafood: resources, nutritional composition and preservation, CRC Press, Inc. Boca Raton, Florida, SAD.</td><td></td><td>1</td></tr>
<tr><td colspan="3">Luten JB., Borresen T., Oehlenschlager J. (1997). Seafood from producer to consumer. Integrated approach to quality. Elsevier, Amsterdam.</td><td></td><td>1</td></tr>
<tr><td colspan="3">Bremner HA. (2002). Safety and quality issues in Fish Processing, CRC Press, Inc. Boca Raton, Florida, SAD</td><td></td><td>1</td></tr>
<tr><td colspan="3">Lovrić T. (2003). Procesi u prehrambenoj industriji, Hinus, Zagreb.</td><td></td><td>1</td></tr>
<tr><td colspan="3">Borresen T. (2008). Improving seafood products for the consumer, Woodhead Publishing Ltd., Cambridge, England.</td><td></td><td>1</td></tr>
<tr><td>Optional literature (at the time of submission of study programme proposal)</td><td colspan="6">Tewari G., Juneja VK. (2007). Advances in thermal and non-thermal food preservation. Blackwell Publishing Ltd. Oxford, UK.<br>Huss HH., Ababouch L., Gram L. (2003). Assessment and Management of Seafood Safety and Quality. Fao Fisheries Technical Paper 444, Food and Agriculture Organization of the United Nations, Rome.<br>Lee R., Lovatelli A., Ababouch L. (2008) Bivalve depuration: fundamental and practical aspects FAO, Rome, Italy.</td></tr>
</table>

| | |
|---|---|
| | Devahastin S. (2011). Physicochemical aspects of food engineering and processing. CRC Press, Inc. Boca Raton, Florida, SAD. |
| Quality assurance methods that ensure the acquisition of exit competences | Teaching and learning quality will be monitored at the level of the i) University, accepting suggestions of students and colleagues, ii) Faculty, conducting surveys from students on teaching quality; iii) Teacher level, through self-analysis. |
| Other (as the proposer wishes to add) | |

# Separation Processes

| **NAME OF THE COURSE** | **Separation Processes** | | | | | |
|---|---|---|---|---|---|---|
| **Code** | KTD210 | Year of study | 2nd | | | |
| Course teacher | PhD, Nenad Kuzmanić, prof.<br>PhD, Marija Ćosić, assistant prof. | Credits (ECTS) | 4.0 | | | |
| Associate teachers | Antonija Kaćunić, assistant | Type of instruction (number of hours) | L | S | E | F |
| | | | 30 | 0 | 15 | |
| Status of the course | Elective | Percentage of application of e-learning | - | | | |
| **COURSE DESCRIPTION** | | | | | | |
| Course objectives | Students are introduced to the theoretical concepts and the application of separation unit operations in chemical engineering that are necessary in a systematic problem solving of procedures related to the mediterranean cultures. Acquired knowledge allows them to evaluate and select the optimal separation process and introduces them to equipment designing with a special emphasis on optimizing the process operating conditions. | | | | | |
| 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, the student are expected to:<br>- acquire the basic theoretical knowledge of an advanced separation processes that are applied in chemical engineering<br>- know how to apply a basic methodology of chemical engineering necessary in a selection of an appropriate processes and devices used in chemical engineering and to define and optimize the process parameters to increase process efficiency<br>- develop a critical approach towards a certain procedures in chemical engineering in terms of their selection, advantages, disadvantages and applications<br>- adopt a methodological approach in device designing that are used in separation engineering | | | | | |
| Course content broken down in detail by weekly class schedule | 1st. week: Separation processes in chemical engineering. Elementary proncipless of separation operations. Mehanical separations principles. Separation processes | | | | | |

<table>
<tr><td>(syllabus)</td><td colspan="2">which include mass and heat transfer.<br>2nd. week: Structure and properties of dispersed systems.<br>3th. week Working principles of separators. Effectiveness of separation. Product purity and yield.<br>4th. week: Separation based on the motion of particles through fluids. Gravity settling processes. Batch sedimentation.<br>5th. week: Rate of sedimentation. Equipment for gravity sedimentation. Sedimentation zones in continuous thickeners. Clarifier and thickener design.<br>6th. week: Centrifugal settling processes. Principles of centrifugal sedimentation. Equipments for centrifugal sedimentation. Centrifugal decanters (tubular centrifuge, disk centrifuge, helical-conveyor centrifuge).<br>7th. week: Hydroclones. Centrifugal filters. Choice of centrifuge.<br>8th. week: Fundamentals of solid-gas separation. Separation by rotating flow (cyclone), Flow field in a cyclone. Collection efficiency and design of cyclones.<br>9th. week: Solid-gas filtration and types of filters. Electrostatic precipitation. Mechanism of an electrostatic precipitator. Mechanisms of scrubbing and types of scrubbers<br>10th. week: Basic concepts of adsorption.<br>11th. week: Adsorption kinetics. Adsorber design.<br>12th. week: Crystallization - elementary principles. Nucleation. Crystal growth theories. Influence of process parameters on final product of crystallization. Crystallizer equipments.<br>13th. week: Elementary concept of extraction and extraction equipment.<br>14th. week: Membrane separation processes. Adventage and disadventage of the membrane separation. Membrane types. Membrane selectivity. Mechanism of mass transfer across the membrane. Product purity and yield.<br>15th. week: Membrane structure. Flow patterns in membrane separators. Concentration polarization. Elementary principles of ultrafiltration, electrodialysis and reverse osmosis.<br><br>Laboratory exercises: Granulometric characterization of dispersed systems by analytical functions. Gravity settling processes - determination of sedimentation rate of suspension. Geometric characteristics determination of gravity settling separator. Impact of process parameters on final product of crystallization. Membrane separation process - reverse osmosis water demineralization.<br><br>Field exercises: Determination of the suspension flow in a centrifuge with a helical-conveyor (treatment plant oily water Cian - Solin). Equipment for gravity sedimentation (wastewater treatment plants Sinj and Trilj). Aeration and its application in biological wastewater treatment (wastewater treatment plant Trilj). Solid-gas filtration: process parameters control of the bag filters and electrofilters (CEMEX - Kastel Sućurac)</td></tr>
<tr><td>Format of instruction</td><td>X lectures<br>☐seminars<br>☐exercises<br>☐on line in entirety<br>☐partial e-learning<br>X field work</td><td>☐independent assignments<br>x multimedia<br>X laboratory<br>☐work with mentor<br>☐ (other)</td></tr>
<tr><td>Student responsibilities</td><td colspan="2">Lecture attendance: 80 %. Laboratory exercises attendance: 100 %.</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 | 2.0 | Research | | Practical training | 0.5 |
| | Experimental work | | Report | | Exercises tests study (Other) | 0.0 |
| | Essay | | Seminar essay | | Field work (Other) | 0.5 |
| | Tests | | Oral exam | 1.0 | (Other) | |
| | Written exam | | Project | | (Other) | |

| | |
|---|---|
| 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. Examination passing rate is 55%. Students who do not pass the partial exams have to take an exam in the regular examination periods. The exam consists the theoretical (oral) part. Oral part will constitute 70%, laboratory exercises and field work will constitute 30% of the final score. |

| | Title | Number of copies in the library | Availability via other media |
|---|---|---|---|
| Required literature (available in the library and via other media) | W.L. McCabe, J.C. Smith, P. Harriott, Unit Operations of Chemical Engineering, McGraw-Hill, 6th edition, New York, 2001. | 3 | |
| | V. Koharić, Mehaničke operacije, Sveučilište u Zagrebu, Zagreb, 1996.; | 3 | |
| | R.H. Perry, D.W. Green, J.O. Maloney, Perry's Chemical Engineer's Handbook, 7th edition, McGraw-Hill, New York, 1999. | 3 | |
| | M. Hraste, Mehaničko procesno inženjerstvo, HINUS, Zagreb, 2003. | 10 | |

| | |
|---|---|
| Optional literature (at the time of submission of study programme proposal) | E. Beer, Priručnik za dimenzioniranje uređaja kemijske procesne industrije, HDKI/Kemija u industriji, Zagreb, 1994. |
| Quality assurance methods that ensure the acquisition of exit competences | - monitoring of students suggestions and reactions during semester<br>- students evaluation organized by University |
| Other (as the proposer wishes to add) | |

# Perfumes and Cosmetics

| NAME OF THE COURSE | Perfumes and Cosmetics | | | | | |
|---|---|---|---|---|---|---|
| **Code** | KTD211 | Year of study | 2nd | | | |
| Course teacher | PhD, Ani Radonić, associate prof. | Credits (ECTS) | 4.0 | | | |
| Associate teachers | | Type of instruction (number of hours) | L | S | E | F |
| | | | 30 | 0 | 15 | |
| Status of the course | Elective | Percentage of application of e-learning | - | | | |
| **COURSE DESCRIPTION** | | | | | | |
| Course objectives | Acquisition of basic knowledge in the field of chemistry of fragrances and fragrant compounds and their significance and application in everyday life.<br>Acquisition of basic knowledge about the most important raw materials which are used in production of cosmetic preparations, types of cosmetic preparations and side effects of cosmetic raw materials and/or preparations on skin and skin appendages. | | | | | |
| 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:<br>-define basic terms associated with chemistry and creation of fragrances<br>- specify perfumery materials of natural origin, methods used to extract ingredients from their natural sources and the most common natural sources<br>- specify and recognize some, the most common synthetic fragrant compounds according to their structural formula<br>- define terms cosmetics and cosmetology<br>- differentiate main classes of ingredients for cosmetics production and specify the most important representatives of each class<br>- differentiate cosmetics according to utilization and specify typical products belonging to each class | | | | | |
| Course content broken down in detail by weekly class schedule (syllabus) | **Lectures (2 hours weekly):**<br>1st week: Introduction to course (course content, students responsibilities, terms and conditions for passing exam). Definitions of terms such as fragrance, fragrant or aroma compound, olfactology, olfaction.<br>2nd week: Olfactory system. Olfactory system disorders. History of discovery, production and use of fragrances.<br>3th week: Perfume types. Classification of fragrances by the origin of the ingredients. Natural, nature-identical, synthetic. The structure of an fragrance. Classification of fragrances by olfactive family.<br>4th week: Olfactive families. Classification by H&R. Classification by M. Edwards – so-called „fragrance wheel“. Classification by fragrance manufacturers.<br>5th week: Fragrance ingredients. Natural ingredients. Methods of natural ingredients isolation. Distillation. Expression. Solvent extraction.<br>6th week: Definitions of natural fragrance ingredients. Aromatics sources. Plant sources. Bark. Flowers. Fruits.<br>7th week: Plant sources. Leaves and twigs. Roots, rhizomes and bulbs. Seeds. Woods. Resins and balsams. | | | | | |

<table>
<tr><td></td><td colspan="6">8th week: Animal sources. Other natural sources. Fragrant compounds. Classification of synthetic ingredients. Classification by functional groups. Alcohols. Aldehydes. Ketones.<br>9th week: $C_{13}$ norisoprenoids.. esters. Lactones. Musks. Phenolics. Hydrocarbons. Heterocyclic compounds.<br>10th week: Definition of terms cosmetics and cosmetology. Significance and classification of cosmetology. Skin and skin appendages. Cosmetics ingredients. Natural ingredients. Inorganic ingredients.<br>11th week: Organic ingredients. Ingredients of plant origin. Ingredients of animal origin. Biogenic stimulants: hormones, vitamins and enzymes.<br>12th week: Semisynthetic ingredients. Synthetic ingredients. Active ingredients and adjuvants. Tensides. Emollients. Thickeners. Preservatives. Antioxidants. Dyes. Sunscreen preparations.<br>13th week: Cosmetic preparations. Definitions of basic terms andclassification. Cleansing products.<br>14th week: Skin care products. Creams, lotions, gels and oils for skin and hair care.<br>15thwek: Decorative cosmetics.</td></tr>
<tr><td>Format of instruction</td><td colspan="3">X lectures<br>X seminars and workshops<br>☐exercises<br>☐on linein entirety<br>☐partial e-learning<br>☐field work</td><td colspan="3">☐ndependent assignments<br>X multimedia<br>☐aboratory<br>☐work with mentor<br>☐ (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. Active participation in teaching process will be also evaluated in the final score.</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></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></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">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. Attendance to the lectures participate in the final score with 10%. Any of the partial exams passed during the semester is valid throughout the academic year.<br>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%.<br>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>Availability via other media</td></tr>
<tr><td colspan="3">The Chemistry of Fragrances, 2nd edition, edited by C. S. Sell, RSC Publishing, Cambridge, 2006.</td><td>-</td><td>Yes, personal property of the lecturer</td></tr>
</table>

| | | | |
|---|---|---|---|
| | M. Čajkovac, Kozmetologija, Naklada Slap, Zagreb, 2000. | 1 | - |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| Optional literature (at the time of submission of study programme proposal) | Poucher's Perfumes, Cosmetics and Soaps, 10th edition, edited by Hilda Butler, Kluwer Academic Publishers, Dordrecht, 2000.<br>Tehnička enciklopedija, vol. 5, str. 360-370, JLZ, Zagreb, 1976.<br>Tehnička enciklopedija, vol. 7, str. 311-319, JLZ, Zagreb, 1980.<br>J. Buckle, Clinical Aromatherapy, Essential Oils in Practice, 2nd edition, Churchill Livingstone, Edinburgh, 2003. | | |
| Quality assurance methods that ensure the acquisition of exit competences | Monitoring of quality assurance will be performed at three levels:<br>(1) University Level, conducting surveys of students on teaching quality;<br>(2) Faculty Level, by Quality Control Committee;<br>(3) Lecturer's Level, monitoring and accepting suggestions of students and colleagues | | |
| Other (as the proposer wishes to add) | | | |

## Physical Biochemistry

| **NAME OF THE COURSE** | **Physical Biochemistry** | | | | | |
|---|---|---|---|---|---|---|
| **Code** | KTD212 | Year of study | 2. | | | |
| Course teacher | PhD, Mladen Miloš, prof. | Credits (ECTS) | 4.0 | | | |
| Associate teachers | PhD, Vesela Torlak, assistant | Type of instruction (number of hours) | L | S | E | F |
| | | | 30 | | 15 | |
| Status of the course | Elective | 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 | 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 | | | | | |

<table>
<tr><td>(syllabus)</td><td colspan="6">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).</td></tr>
<tr><td>Format of instruction</td><td colspan="3">x lectures<br>x seminars and workshops<br>x exercises<br>☐on linein entirety<br>x partial e-learning<br>☐field work</td><td colspan="3">x independent assignments<br>x multimedia<br>x laboratory<br>☐work with mentor<br>☐ (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>2</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>1</td><td>(Other)</td><td></td></tr>
<tr><td>Tests</td><td></td><td>Oral exam</td><td>0,5</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></td><td colspan="5"></td></tr>
<tr><td>Grading and evaluating student work in class and at the final exam</td><td colspan="6">Activity during attendance, presentation of seminar papers in the form of a Power Point presentation and final oral exam.</td></tr>
<tr><td rowspan="9">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">Internal script Physical Biochemistry</td><td>-</td><td colspan="2">Web page of Faculty</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 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">- N. C. Price et al., Principles and problems in Physical chemistry for Biochemists, Third edition, Oxford University Press, Oxford, 2001.<br>- P. Atkins and J. De Paula, Physical chemistry, 8ed, Oxford University Press, Oxford, 2006.</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) Level of teachers.</td></tr>
</table>

| | |
|---|---|
| Other (as the proposer wishes to add) | |

# Packaging

| NAME OF THE COURSE | Packaging | | | | | |
|---|---|---|---|---|---|---|
| **Code** | KTD216 | Year of study | 2nd | | | |
| Course teacher | PhD, Nataša Stipanelov Vrandečić, prof. | Credits (ECTS) | 4.0 | | | |
| Associate teachers | | Type of instruction (number of hours) | L | S | E | F |
| | | | 30 | | 30 | |
| Status of the course | Mandatory | Percentage of application of e-learning | - | | | |
| **COURSE DESCRIPTION** | | | | | | |
| Course objectives | To provide an understanding of basic functions of packaging in accordance with the characteristics of the product and market requirements. | | | | | |
| 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 successfully passed exam student should be able to:<br>- define the main functions of packaging<br>- identify the characteristics of different kind of goods and its sensitivity on external influences<br>- describe and identify various packaging materials for goods<br>- describe the manufacturing of packaging<br>- identify the interactions in food - packaging system<br>- design packaging solution<br>- perform analysis of packaging materials in laboratory and to interpret collected data<br>- participate in team work and to present seminar essay | | | | | |
| Course content broken down in detail by weekly class schedule (syllabus) | 1st week: Introduction.<br>2nd week: Classification of packaging<br>3rd week: Functions of packaging<br>4th week: Types and characteristics of foodstuff<br>5th week: Packaging materials: wood; paper; paperboard; metals<br>6th week: Polymeric materials: characteristics and classification; cellulose materials, polyethylene, polypropylene, vinyl polymers<br>7th week: Polystyrene, polyesters, polyamides, polyurethanes; biodegradable polymeric materials<br>8th week: Manufacturing of polymer packaging.<br>9th week: Multilayer packaging materials. Glass.<br>First test.<br>10th week: Packaging forms<br>11th week: Interactions between food and packaging materials. Packaging for cereals, bakery and confectionery goods<br>12th week: Packaging for fruits and vegetables; meat and fish; | | | | | |

<table>
<tr><td></td><td colspan="6">13th week: Packaging for milk and diary products, alcoholic and soft beverages<br>14th week: Packaging waste and environment<br>15th week: Presentation of students seminar essays<br>Second test.<br><br>Laboratory exercises:<br>1. Analysis of packaging material dimensions<br>2. Analysis of paper<br>3. Analysis of metal packaging materials<br>4. Analysis of polymeric packaging materials<br>5. Analysis of multilayer packaging materials<br>6. Analysis of complex packaging</td></tr>
<tr><td>Format of instruction</td><td colspan="3">X lectures<br>☐seminars and workshops<br>x exercises<br>☐on line in entirety<br>☐partial e-learning<br>☐field work</td><td colspan="3">x independent assignments<br>x multimedia<br>X laboratory<br>☐work with mentor<br>☐ (other)</td></tr>
<tr><td>Student responsibilities</td><td colspan="6">Lecture attendance: 80 %. Laboratory exercises attendance: 100 %. The preparation and presentation of seminar essay (team work)</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>0.68</td><td>Report</td><td></td><td>Exercises tests study (Other)</td><td></td></tr>
<tr><td>Essay</td><td></td><td>Seminar essay</td><td>1.00</td><td>Field work (Other)</td><td>0.5</td></tr>
<tr><td>Tests</td><td>1.32</td><td>Oral exam</td><td>(0.66)</td><td>(Other)</td><td></td></tr>
<tr><td>Written exam</td><td>(0.66)</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">CONTINUOUS EVALUATION<br>The complete exam can be passed through two partial tests during semester.<br>Attendance on lectures, $A_1$(successfulness =70 -100 %), share in grade, $k_1$ =0,1<br>Laboratory exercises, $A_2$(successfulness =60 -100 %), share in grade, $k_2$ =0,15<br>Seminar essay +presentation , $A_3$(successfulness =50 -100 %), share in grade, $k_3$ =0,15<br>1st test, $A_4$ (successfulness =60 -100 %), share in grade, $k_4$ =0,30<br>2nd test, $A_5$ (successfulness =60 -100 %), share in grade, $k_5$ =0,30<br><br>GRADE (%) = $0,10A_1+0,15A_2 + 0,15A_3+ 0,30A_4 + 0,30A_5$<br><br>FINAL EVALUATION<br>Students who did not take or pass partial tests have to attend to written and oral exam in the regular exam periods.<br>Activities A1, A2 and A3 are evaluated in the same way as indicated above.<br>Written exam, $A_6$ (successfulness =60 -100 %), share in grade, $k_6$ =0,20<br>Oral exam, $A_7$ (successfulness =60 -100 %), share in grade, $k_7$ =0,40<br>GRADE (%) = $0,10A_1+0,15A_2 + 0,15A_3+ 0,20A_6 + 0,40A_7$<br><br>FINAL GRADE: successful (60% – 70 %), good (71% – 80 %), very good (81% – 90 %), excellent (91% – 100 %).</td></tr>
</table>

<table>
<tr><td></td><td colspan="3">In the case that student passed only one test during continuous evaluation, he/she have to attend to written and oral exam in the regular exam periods. The passed test will be recognized by the end of the academic year as a part of the written exam.</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>1. N. Stipanelov Vrandečić: Ambalaža, Kemijsko-tehnološki fakultet, Split, 2010.</td><td>1</td><td>Web site of institution</td></tr>
<tr><td>I. Vuković,K. Galić i M. Vereš: Ambalaža za pakiranje namirnica, Tectus, Zagreb, 2007.</td><td>1</td><td></td></tr>
<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">Pravilnik o ambalaži i ambalažnom otpadu (NN/2005)<br>Pravilnik o zdravstvenoj ispravnosti materijala i predmeta koji dolaze u neposredni dodir s hranom (NN/2008)<br>Z. Janović: Polimerizacije i polimeri, Hrvatsko društvo kemijskih inženjera i tehnologa , Zagreb, 1997</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>
</table>

# 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 | 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 |
|---|---|
| Applied Mathematics | Nives Baranović, lecturer |
| Atmospheric Chemistry | PhD, Marija Bralić, assosciate prof.<br>PhD, Maša Buljac, assistant prof., Nenad Periš, assistant |
| Biochemical Engineering | PhD, Davor Rušić, prof. |
| Biochemistry | PhD, Olivera Politeo, associate prof.<br>PhD, Franko Burčul, assistant Ivana Carev, assistant |
| Biotechnological Processes | PhD, Branka Andričić, prof.<br>PhD, Sanja Perinović Jozić, assistant prof. |
| Chemical Reactors | PhD, Sandra Svilović, associate prof. |
| Chemistry and Technology of Aromatic Plants | PhD, Igor Jerković, prof. |
| Chemistry of Sea | PhD, Marija Bralić, associate prof.<br>PhD, Maša Buljac, assistant prof. |
| Citrus Processing | PhD, Ivana Generalić Mekinić, assistant prof. |
| Coatings | PhD, Nataša Stipanelov Vrandečić, prof. |
| Corrosion and Degradation of Building Materials | PhD, Jelica Zelić, prof.<br>PhD, Mario Nikola Mužek, assistant |
| Corrosion and Materials Protection | PhD, Maja Kliškić, prof. |
| Corrosion and the Environment | PhD, Ladislav Vrsalović, associate prof. |
| Corrosion Inhibitors | PhD, Senka Gudić, prof. |
| Direct Energy Conversion | PhD, Senka Gudić, prof. |
| Ecotoxicology | PhD, Jasna Maršić Lučić, associate prof. |
| Electrochemical Engineering | PhD, Maja Kliškić, prof. |
| Electrochemical Methods and Their Application | PhD, Senka Gudić, prof. |
| Electrodeposition Proceses | PhD, Ladislav Vrsalović, associate prof. |
| Energy and Development | PhD, Mirko Marušić, senior lecturer |
| Environmental Chemistry | PhD, Marija Bralić, associate prof.<br>PhD, Maša Buljac, assistant prof. |

| | |
|---|---|
| Environmental Engineering | PhD, Nenad Kuzmanić, prof.<br>Antonija Kaćunić, assistant |
| Environmental Management System | PhD, Marijo Buzuk, assistant prof.<br>PhD, Maša Buljac, assistant prof. |
| Essentials of Ecology | PhD, Mladen Šolić, prof. |
| Fruit and Vegetable Processing | PhD, Tea Bilusic, prof.<br>PhD, Daniela Skroza, assistant |
| General Biology | PhD, Nada Bezić, prof.<br>PhD, Valerija Dunkić, associate prof. |
| General microbiology | PhD, Mirjana Skočibušić, associate prof.<br>PhD, Ana Maravić, assistant prof. |
| Glass and Ceramics | PhD, Jelica Zelić, prof.<br>PhD, Mario Nikola Mužek, assistant |
| Grape Processing | PhD, Ivana Generalić Mekinić, assistant prof. |
| Hygiene and Sanitation | PhD, Tea Bilušić, prof.<br>PhD, Mirjana Skočibušić, associate prof. |
| Inorganic Processes in Heterogeneous Systems | PhD, Jelica Zelić, prof.<br>PhD, Mario Nikola Mužek, assistant |
| Instrumental Methods of Analysis | PhD, Lea Kukoč Modun, assistant prof.<br>Maja Biočić, assistant, Andrea Anđić, assistant, Azra Đulović, assistant |
| Ionization Radiation in Biosphere | PhD, Magdi Lučić Lavčević, associate prof. |
| Marine and Submarine Mineral Raw Materials | PhD, Miroslav Labor, associate prof. |
| Mechanical and Thermal Operations | PhD, Marija Ćosić, assistant prof.<br>PhD, Nenad Kuzmanić, prof., Antonija Kaćunić, assistant |
| Mediterranean Diet | PhD, Tea Bilusic, prof.<br>Tonča Koludrović, assistant |
| Microbiology of Polluted Waters | PhD, Nada Krstulović, prof. |
| Nanotechnology and the Environment | PhD, Magdi Lučić Lavčević, associate prof. |
| Naturally Occuring Polymeric Materials | PhD, Branka Andričić, prof. |
| New Inorganic Materials | PhD, Pero Dabić, prof.<br>PhD, Damir Barbir, assistent prof. |
| Non-metallic Composites | PhD, Pero Dabić, prof. |
| Packaging | PhD, Nataša Stipanelov Vrandečić, prof. |
| Perfumes and Cosmetics | PhD, Ani Radonić, associate prof. |
| Physical Biochemistry | PhD, Mladen Miloš, prof.<br>PhD, Vesela Torlak, assistant |
| Polymer Blends and Composites | PhD, Branka Andričić, prof. |
| Polymer Processing | PhD, Matko Erceg, associate prof. |
| Polymerization Processes | PhD, Matko Erceg, associate prof. |
| Polymers and the Environment | PhD, Branka Andričić, prof. |
| Polymers Characterization | PhD, Nataša Stipanelov Vrandečić, prof. |
| Process Automatic Control | PhD, Jadranka Marasović, prof.<br>PhD, Sandra Svilović, associate prof. |
| Process Design | PhD, Nediljka Vukojević Medvidović, associate prof. |
| Processes in Food Industry | PhD, Ivana Generalić Mekinić, assistant prof. |
| Processing of Olives | PhD, Ivica Ljubenkov, assistant prof. |
| Quality Assurance of Food | PhD, Josipa Giljanović, associate prof. |
| Recycling of Plastics | PhD, Matko Erceg, associate prof. |
| Sea Pollution | PhD, Grozdan Kušpilić, assistant prof.<br>PhD, Maja Krželj, assistant prof. |
| Seafood processing and quality assurance | PhD, Vida Šimat, assistant prof. |

| | |
|---|---|
| Separation Processes | PhD, Nenad Kuzmanić, prof., PhD, Marija Ćosić, assistant prof.<br>Antonija Kaćunić, assistant |
| Soil Chemistry | PhD, Maša Buljac, assistant prof. |
| Solid Waste and Recycling | PhD, Ladislav Vrsalović, associate prof.<br>PhD, Ivana Smoljko, assistant prof. |
| Solidification and Stabilization Processes | PhD, Pero Dabić, prof.<br>PhD, Damir Barbir, assistent prof. |
| Structure and Properties of Inorganic Non-metallic Materials | PhD, Jelica Zelić, prof.<br>PhD, Mario Nikola Mužek, assistant |
| Structure and Properties of Polymers | PhD, Matko Erceg, associate prof. |
| Surface Protection Technology | PhD, Ladislav Vrsalović, associate prof. |
| Technology of Building Materials | PhD, Dražan Jozić, associate prof. |
| Thermodinamics of Real Processes | PhD, Vanja Martinac, prof.<br>PhD, Miroslav Labor, associate prof., PhD, Jelena Jakić, assistant |
| Wastewater Engineering | PhD, Nediljka Vukojević Medvidović, associate prof.<br>PhD, Ivona Nuić, assistant |
| Water Chemistry | PhD, Marijo Buzuk, assistant prof.<br>PhD, Maša Buljac, assistant prof. |
| Water Technology | PhD, Marina Trgo, 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 | Polymer Blends and Composites<br>Naturally Occuring Polymeric Materials<br>Polymers and the Environmenta<br>Biotechnological Processes |
| 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<br>2. Composite Polymeric Materials – graduate study of Chemical Technology (Materials)<br>3. Polymer Blends **-** phD study Chemical Engineering in materials development and Environmental Protection<br>4. 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.*<br>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*<br>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*<br>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, 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 | **Nives Baranović, lecturer** |
| The course he/she teaches in the proposed study programme | Applied Mathematics |
| GENERAL INFORMATION ON COURSE TEACHER | |
| Address | Marasovića 57/4 |
| Telephone number | ++385 95 85 72 585 |
| E-mail address | njozic@ffst.hr; nives.baranovic@gmail.com |
| Personal web page | |
| Year of birth | 1973 |
| Scientist ID | |
| 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 | Lecturer, 2011. |
| Area and field of election into research or art rank | Natural Sciences, Mathematics, Mathematic analysis |
| INFORMATION ON CURRENT EMPLOYMENT | |
| Institution where employed | Faculty of Humanities and Social Sciences, University of Split |
| Date of employment | February 1st, 2011. |
| Name of position (professor, researcher, associate teacher, etc.) | Lecturer |
| Field of research | Mathematics |
| Function | Lecturer |
| INFORMATION ON EDUCATION – Highest degree earned | |
| Degree | Professor of mathematics and informatics |
| Institution | Faculty of Sciences, University of Split |
| Place | Split |
| Date | 1998. |
| INFORMATION ON ADDITIONAL TRAINING | |
| Year | Since 1999. continously |
| Place | Zagreb, Split, Opatija, Šibenik |
| Institution | MZOŠ, AZOO, NCVVO, HMD |
| Field of training | Mathematics, Psychology, Pedagogy, Education |
| MOTHER TONGUE AND FOREIGN LANGUAGES | |
| Mother tongue | Croatian |
| Foreign language and command of | English (4) |

| | |
|---|---|
| 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) | 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) | Monitoring the work of teachers and professors of mathematics, AZOO, 2006. – 2011., senior adviser for mathematics;<br>Mathematics 1, Faculty of Maritime Studies, University of Split, 2010.-2011., assistent;<br>Mathematics 1, Faculty of Electrical Engineering, Mechanical Engineering and Naval Architecture, University of Split, 2007.-2010., assistent;<br>Applied Mathematics, Faculty of Electrical Engineering, Mechanical Engineering and Naval Architecture, University of Split, 2007.-2009., assistent;<br>Mathematics and informatics, Elementary School Manuš, Split, 1999. – 2006., teacher;<br>Methodics of mathematics, Faculty of Sciences, University of Split, 2004. – 2006., assistent;<br>Informatics, Highschool Queen Jelena, Split, 2004. – 2006., teacher;<br>Mathematics and Informatics, Technical School Ban Josip Jelačića, Sinj, 1998. – 1999., teacher. |
| 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. Baranović, Nives. 2014. ”Potencijal jednog zadatka izveden na temelju Talesovog teorema o proporcionalnim dužinama“, U zborniku radova Peti simpozijum Matematika i primene, Beograd: Matematički fakultet.<br>2. Jozić, Nives. 2013. “Formuliranje matematičkih definicija i iskaza teorema u svrhu kritičkog promišljanja i zaključivanja”, U zborniku radova Četvrti simpozijum Matematika i primene, Beograd: Matematički fakultet.<br>3. Jozić, Nives; Mateljević Miodrag; Svetlik, Marek. 2012. ”Istraživanjem do minimuma ili maksimuma”, U zborniku radova Treći simpozijum Matematika i primene, uredili Stanimirović, Zorica, Marić Miroslav i Svetlik, Marek, 35 – 54. Beograd: Matematički fakultet.<br>4. Jozić, Nives. 2010. ”Muke po trapezu ili raskoš trapeza”, U zborniku radova Četvrti kongres nastavnika matematike RH, uredili Ivanšić, Ivan; Mladinić, Petar; Svedrec, Renata, 263 – 280. Zagreb:Školska knjiga |
| Professional and scholarly articles published in the last five years in subjects of teaching methodology and teaching quality (5 works at most) | 1. Baranović, Nives. 2014. ”Učenje temeljeno na čitanju s razumijevanjem”, U e-zborniku povzetkov 2. mednarodne Konference o učenju in poučevanju matematike (KUPM 2014), dostupno na: http://www.zrss.si/kupm2014/files/povzetki-cetrtek-SLO/#/8/.<br>2. Jozić, Nives. 2012. ”Učenje usmjerenim opažanjem”, U zborniku prispevkov 1. mednarodna Konferenca o učenju in poučevanju matematike, uredili Kmetič, Silva, Bone Jerneja, Rajh Sonja, Sambolić Beganović Amela, Sirnik, Mateja i Suban Ambrož, Mojca, 58 - 66. Maribor: |

| | |
|---|---|
| | http://www.zrss.si/pdf/zbornikprispevkovkupm2012.pdf<br>3. Jozić, Nives. 2012. ”Fotografija kao inovativno nastavno sredstvo”, U zborniku radova Peti kongres nastavnika matematike RH, uredili Ivanšić, Ivan; Mladinić, Petar; Svedrec, Renata, 257 – 270. Zagreb: Profil<br>4. Jozić, Nives. 2011. ”Računalo u nastavi matematike: zašto, kada i kako?”, U zborniku radova Drugi simpozijum Matematika i primene (2), uredio Protić, Ljubomir, 17 – 27. Beograd: Razvojno-istraživački centar grafičkog inženjerstva<br>5. Jozić, Nives. 2009. „Pisane provjere znanja i teorija kaosa”, U zborniku radova Didaktička dokimologija (Praćenje, ispitivanje, vrednovanje i ocjenjivanje), Šesti stručno-metodički skup Metodika nastave matematike u osnovnoj i srednjoj školi, uredili Gortan, Robert; Mrkonjić, Ivan; Varošanec, Sanja, 137 – 156. Pula: Hrvatsko matematičko društvo, Podružnica Istra |
| Professional, science and artistic projects in the field of the course carried out in the last five years (5 at most) | 1. According to the resolution of Faculty of Humanities and Social Sciences, University of Split assembley (Klasa: 003-08/15-06/0015, Ur.broj: 2181-190-00-15-0038 i Ur.broj: 2181-190-00-15-0042) my two lectures were published online on Faculties website: Basics of mathematical logic and Basics of sets. The lectures can be viewed online: http://www.ffst.unist.hr/knjiznica/izdavastvo/predavanja.<br>2. During 2015. i 2016. on Faculty of Humanities and Social Sciences, University of Split (in cooperation with University of Zadar) I made experimental study under name Cognitive development and learning outcomes of geometry of students of teacher studies (KRIUGS 2015). |
| 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? | In the normal course of study (profesor of mathematics and informatics) and through continuous lifelong learning since 1999. |
| PRIZES AND AWARDS, STUDENT EVALUATION | |
| Prizes and awards for teaching and scholarly/artistic work | Award of Splitsko-dalmatinska županija for excellent work with talented pupils, 2000. – 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, Nada Bezić, prof.** |
| The course he/she teaches in the proposed study programme | General Biology |
| GENERAL INFORMATION ON COURSE TEACHER | |
| Address | Rendićeva 17. Split |
| Telephone number | +385(0)384-861 |
| E-mail address | bezic@pmfst.hr |
| Personal web page | http://www.pmfst.hr |

| | |
|---|---|
| Year of birth | 1953 |
| Scientist ID | 105170 |
| Research or art rank, and date of last rank appointment | Scientific Advisor, 22. 05. 2013. |
| Research-and-teaching, art-and-teaching or teaching rank, and date of last rank appointment | Professor, 28. 06. 2013. |
| Area and field of election into research or art rank | Natural Science, Biology |
| INFORMATION ON CURRENT EMPLOYMENT | |
| Institution where employed | Faculty of Natural Science, Split |
| Date of employment | 1981. |
| Name of position (professor, researcher, associate teacher, etc.) | Professor |
| Field of research | Botany- secondary metabolites, plant viruses |
| Function | |
| INFORMATION ON EDUCATION – Highest degree earned | |
| Degree | PhD |
| Institution | Faculty of Natural Science, University of Zagreb |
| Place | Zagreb |
| Date | 1991. |
| INFORMATION ON ADDITIONAL TRAINING | |
| Year | 1997. i 1998 godine. |
| Place | Glasgow UK (Scotland) i Prag (Republka Češka) |
| Institution | University of Glasgow, Division of Enviromental and Evolutionary Biology i Charles University, Department of Plant Physiology |
| Field of training | Plant anatomy |
| 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 4/5 |
| 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) | Cell biolgy, General Botany, Botany, Flavour and Aromatic Plants, Virology<br>Biology and chemistry and Nutrition on Faculty of Natural Science, University of Split |
| Authorship of university/faculty textbooks in the field of the course | Lectures of cours Cell biolgy and General Botany on websites of Faculty of Natural Sciences University of Split |
| Professional, scholarly and artistic articles published in the last five years in the field of the course (5 works at most) | 1. Kremer, Dario; Dragojević, Müller Ivna; Edith, Stabentheiner; Vitali, Dubravka; Kopričanec, Martina; Ruščić, Mirko; Kosalec, Ivan; **Bezić, Nada**; Dunkić, Valerija: Phytochemical and micromorphological traits of endemic *Micromeria pseudocroatica* Šilić (Lamiaceae). Natural Product Communications. **7.** 2012. 1667-1670.<br>2. Dunkić, Valerija; Kremer, Dario; Dragojević Müler, Ivna; |

| | |
|---|---|
| | Stabentheiner, Edith; Kuzmić, Sunčica; Jurišić Grubešić, Renata; Vujić, Lovorka; Kosalec, Ivan; Randić, Marko; Srečec, Siniša; **Bezić, Nada**. Chemotaxonomic and micromorphological traits of Satureja montana L. and S. subspicata Vis. (Lamiaceae). Chemistry & biodiversity. 9. 2012. 2825 – 2842.<br>3. Dario, Kremer; Ivna, Dragojević, Müller; Valerija, Dunkić; Dubravka, Vitali; Edith, Stabentheiner; Andreas, Oberländer; **Nada, Bezić**; Ivan, Kosalec. Chemical traits and antimicrobial activity of endemic Teucrium arduini L. from Mt Biokovo (Croatia). Central European Journal of Biology. 7**.** 2012. 941**-**947.<br>4. **Bezić, Nada;** Elma, Vuko; Valerija, Dunkić; Mirko, Ruščić; Ivica, Blažević; Franko, Burčul. Antiphytoviral Activity of Sesquiterpene-Rich Essential Oils from Four Croatian *Teucrium* Species. Molecules 16. 2011. 8119-8129.<br>5. **Bezić, Nada**; Šamanić, Ivica; Dunkić, Valerija; Besendorfer, Višnja; Puizina, Jasna. Essential Oil Composition and Internal Transcribed Spacer (ITS) Sequence Variability of Four South-Croatian *Satureja* Species (Lamiaceae). Molecules 14. 2009. 925-938. |
| 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 MSES Republic of Croatia Xerophytes and their Secondary Metabolites (177-1191192-0830)<br><br>1. Kremer, Dario; Dragojević, Müller Ivna; Edith, Stabentheiner; Vitali, Dubravka; Kopričanec, Martina; Ruščić, Mirko; Kosalec, Ivan; **Bezić, Nada**; Dunkić, Valerija: Phytochemical and micromorphological traits of endemic *Micromeria pseudocroatica* Šilić (Lamiaceae). Natural Product Communications. **7.** 2012. 166**7-**1670.<br>2. Dunkić, Valerija; Kremer, Dario; Dragojević Müler, Ivna; Stabentheiner, Edith; Kuzmić, Sunčica; Jurišić Grubešić, Renata; Vujić, Lovorka; Kosalec, Ivan; Randić, Marko; Srečec, Siniša; **Bezić, Nada**. Chemotaxonomic and micromorphological traits of Satureja montana L. and S. subspicata Vis. (Lamiaceae). Chemistry & biodiversity. 9. 2012. 2825 – 2842.<br>3. Dario, Kremer; Ivna, Dragojević, Müller; Valerija, Dunkić; Dubravka, Vitali; Edith, Stabentheiner; Andreas, Oberländer; **Nada, Bezić**; Ivan, Kosalec. Chemical traits and antimicrobial activity of endemic Teucrium arduini L. from Mt Biokovo (Croatia). Central European Journal of Biology. 7**.** 2012. 941**-**947.<br>4. **Nada, Bezić;** Elma, Vuko; Valerija, Dunkić; Mirko, Ruščić; Ivica, Blažević; Franko, Burčul. Antiphytoviral Activity of Sesquiterpene-Rich Essential Oils from Four Croatian *Teucrium* Species. Molecules 16. 2011. 8119-8129. |

| | |
|---|---|
| | 5. **Bezić, Nada**; Šamanić, Ivica; Dunkić, Valerija; Besendorfer, Višnja; Puizina, Jasna. Essential Oil Composition and Internal Transcribed Spacer (ITS) Sequence Variability of Four South-Croatian *Satureja* Species (Lamiaceae). Molecules 14. 2009. 925-938 |
| 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, Tea Bilušić, prof.** |
| The course he/she teaches in the proposed study programme | Hygiene and Sanitation<br>Mediterranean Diet<br>Fruit and Vegetable Processing |
| GENERAL INFORMATION ON COURSE TEACHER | |
| Address | Ruđera Boškovića 35, 21 000 Split, Croatia |
| Telephone number | +385 21 329 466 |
| E-mail address | tea@ktf-split.hr |
| Personal web page | https://tkojetko.irb.hr/znanstvenikDetalji.php?sifznan=8413 |
| Year of birth | 1973 |
| Scientist ID | 238765 |
| Research or art rank, and date of last rank appointment | Science Adviser - 13.07.2012. |
| Research-and-teaching, art-and-teaching or teaching rank, and date of last rank appointment | Full professor 23.05. 2013. |
| Area and field of election into research or art rank | Biotechnical Sciences, Food Technology |
| INFORMATION ON CURRENT EMPLOYMENT | |
| Institution where employed | Faculty of Chemistry and Technology, University of Split |
| Date of employment | 1.01.2002. |
| Name of position (professor, researcher, associate teacher, etc.) | Professor |
| Field of research | Food Science |
| Function | Full professor |
| INFORMATION ON EDUCATION – Highest degree earned | |

| | |
|---|---|
| Degree | Ph.D. |
| Institution | Faculty of Food Technology and Biotechnology, University of Zagreb |
| Place | Zagreb |
| Date | 14.06.2004. |
| INFORMATION ON ADDITIONAL TRAINING | |
| Year | 2000-2001<br>2002-2003<br>2006-2008 |
| Place | Paris, France<br>Fribourg, Switzerland<br>Freising, Germany<br>Regensburg, Germany |
| Institution | INRA, Institut National de la Recherche Agronomique<br>Faculty of Science, Department of Biology, University of Fribourg<br>Faculty of Food Science, Chair of Food Biofunctionality, Technical Univeristy of Munich (TUM)<br>Faculty of Chemistry, University of Regensburg |
| Field of training | - isolation and characterization of probiotic *Lactobacillus* species from yogurth<br>- isolation of phytochromes from model plant *Arabidopsis thaliana*<br>- biologicallly active compounds from sea fennel and caper<br>- low melting sugars |
| 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 (4) |
| 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) | |
| 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) | - Hygiene and Sanitation: graduate study of Chemical Technology (2007 – today)<br>- Introduction to Food Science: specialist study of Food Technology (2007 – today)<br>- Mediterranean Diet graduate study of Chemical Technology (2012- today)<br>- Dietetics, Study of Pharmacy, (2010- today) |
| Authorship of university/faculty textbooks in the field of the course | - Introduction to Food Science, revised teaching course, web pages of the Faculty of Chemistry and Technology, 2013<br>- Hygiene and Sanitation, revised teaching course, web page of the Faculty of Chemistry and Technology, 2016<br>- Dietetics, revised teaching course, web pages of the Faculty of Chemistry and Technology, 2013 |
| Professional, scholarly and artistic articles published in the last five years in the field of the course (5 works at most) | 1. Zorić, Z., Markić, J., Pedisić, S., Bučević-Popović, V., Generalić-Mekinić, I., Grebenar, K., **Kulišić-Bilušić, T**.: Stability of rosmarinic acid in aqueous extracts from different Lamiaceae species after *in vitro* digestion with |

| | |
|---|---|
| | human gastrointestinal enzymes. 2016. *Food Technology and Biotechnology,* doi: 10.17113/ftb.54.01.16.4033<br>2. Poljuha, D., Šola, I., Bilić, J., Dudaš, S., **Bilušić, T**., Markić, J., Rusak, G. Phenolic composition antioxidant capacity, energy content and gastrointestinal stability of Croatian wild edible plants. 2015. *European Food Research and Technology,* 214, 573-585.<br>3. Bučević-Popović, V., Delaš, I., Međugorac, S., Pavela-Vrančić, M., **Kulišić-Bilušić, T**. Oxidative stability and antioxidant activity of bovine, caprine, ovine and asinine milk. 2014. *International Journal of Dairy Technology,* 67, 394-401.<br>4. **Kulisic-Bilusic, T**., Schmöller, I., Schnäbele, K., Siracusa, L., Ruberto, G.:The anticancerogenic potential of essential oil and aqueous infusion from caper (Capparis spinosa L.) , *Food Chemistry (2012), 132, 261-267*<br>5. Siracusa, L., **Kulisic-Bilusic, T**., Politeo, O., Krause, I., Dejanovic, B., Ruberto, G.:Phenolic composition and antioxidant activity of aqueous infusions from *Capparis spinosa* L. and *Crithmum maritimum* L. before and after submission to a two-step *in vitro* digestion model, *Journal of Agricultural and Food Chemistry(2011), 59, 12453-9* |
| 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. Lipidic, phenolic and genetic profile of Croatian autochthonous varieties of olives: *Oblica*, *Levantinka*, *Buhavica*, *Drobnica* after conventional and early harvesting period, financed by Split-Dalmatian County<br>2. Enhancement of the stability and the bioavailability of selected phytochemicals using different delivery systems and mathematical modeling of an *in vitro* digestion model, bilateral project between the Repulic of Croatia and the Republic of Serbia<br>3. The role of cholinesterases in cell differentiation and their inhibition by flavonoids and flavonoid-metal complexes, HRZZ; voditelj projekta: prof. dr. Herwig O. Gutzeit, University of Dresden, Germany<br>4. Antioxidants and inhibitors of AChE from aromatic plants, Ministry of Science, Republic of Croatia |
| 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, Marija Bralić, associate prof.** |
|---|---|
| The course he/she teaches in the proposed study programme | Chemistry of Sea<br>Atmospheric Chemistry<br>Environmental Chemistry |
| 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)<br>Exercises in Analytical chemistry (GS) |
| 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) | **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<br>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<br>**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<br>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<br>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, Maša Buljac, assistant prof.** |
| The course he/she teaches in the proposed study programme | Soil Chemistry |
| GENERAL INFORMATION ON COURSE TEACHER | |
| Address | Ruđera Boškovića 35, 21000 Split, Croatia |
| Telephone number | 00 385 (0) 21 329 479 |
| E-mail address | masa@ktf-split.hr |
| Personal web page | |
| Year of birth | 1974 |
| Scientist ID | 325126 |
| Research or art rank, and date of last rank appointment | Research Associate, 8. travnja 2015. |
| Research-and-teaching, art-and-teaching or teaching rank, and date of last rank appointment | Assistant professor, 9. prosinca 2015. |
| 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. June2009. |
| Name of position (professor, researcher, associate teacher, etc.) | Assistant professor |
| Field of research | Environmental analytical chemistry |
| Function | |
| INFORMATION ON EDUCATION – Highest degree earned | |
| Degree | Ph.D. |
| Institution | Facultyof Chemical Engineering and Technology, University ofZagreb |
| Place | Zagreb |
| Date | 16. July2012. |
| 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) | |
| 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) | **Buljac,Maša**; Bogner, Danijela; Bralić, Marija; Periš, Nenad; Buzuk, Marijo; Brinić, Slobodan; Vladislavić, Nives. CadmiumandLeadDistributionin Marine SoilSediments, TerrestialSoil, TerrestialRock, andAtmosphericParticulateMatteraround Split, Croatia, *AnalyticalLetters*47 (2014), 11; 1952-1964<br>**Buljac**, **M.,**Bogner, D., Cerjan-Stefanović, Š., Bolanča, T., Margeta, K.,CrandZndistributionin sediment fromthesemi-enclosed Kaštela Bay, the Adriatic Sea (Croatia),*FreseniusEnvironmentalBulletin*, 20 (2011) 853-860. |
| 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? | Participation in professional development: "The development and improvement of teaching competence of university teachers." |
| 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 | Water Chemistry<br>Environmental Managment System |
| 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:<br>1. General chemistry<br>2. General chemistry with stoichiometry<br>3. General and Inorganic chemistry<br>4. Inorganic Chemistry<br>5. Water Chemistry<br>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<br>2. Bralić, Marija; Buzuk, Marijo; Buljac, Maša; Brinić, |

| | |
|---|---|
| | Slobodan.<br>Potentiometric Studies on Chemically and Electrochemically Prepared Sulfide Active Materials for Determination of Copper(II). // *International Journal of Electrochemical Science*. 9 (2014); 4854-4865<br><br>3. Brinić, Slobodan; Vladislavić, Nives; Buzuk, Marijo; Bralić, Marija; Šolić, Mislav.<br>Bismuth film random array carbon fiber micro electrodes for determination of cysteine and N-acetyl cysteine. // *Journal of electroanalytical chemistry*. 705 (2013); 86-90<br><br>4. Brinić, Slobodan; Buzuk, Marijo; Bralić, Marija; Generalić, Eni.<br>Solid-contact Cu(II) ion-selective electrode based on 1, 2 di (o salicylaldiminophenylthio)ethane. // *Journal of solid state electrochemistry*. 16 (2012); 1333-1341<br><br>5. Bralić, Marija; Buljac, Maša; Buzuk, Marijo; Brinić, Slobodan.<br>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, Marija Ćosić, assistant prof.** |
| The course he/she teaches in the proposed study programme | Mechanical and Heat Transfer Operations<br>Separation Processes |
| GENERAL INFORMATION ON COURSE TEACHER | |
| Address | Ruđera Boškovića 35, 21000 Split |
| Telephone number | 021/329-453 |
| E-mail address | akrap@ktf-split.hr |
| Personal web page | |
| Year of birth | 1977 |
| Scientist ID | 267161 |
| Research or art rank, and date of last rank appointment | Scientific associate – December 7th, 2010 |
| Research-and-teaching, art-and-teaching or teaching rank, and date of last rank appointment | Assistant professor – March 31st, 2011 |
| Area and field of election into research or art rank | Technical sciences, chemical engineering |
| INFORMATION ON CURRENT EMPLOYMENT | |
| Institution where employed | University of Split, Faculty of Chemistry and Technology |
| Date of employment | September 1st, 2004 |
| Name of position (professor, researcher, associate teacher, etc.) | assistant professor |
| Field of research | Mechanical, thermal and separation processes |
| Function | |
| INFORMATION ON EDUCATION – Highest degree earned | |
| Degree | PhD |
| Institution | Faculty of Chemistry and Technology, University of Split |
| Place | Split |
| Date | July 24th, 2010 |
| INFORMATION ON ADDITIONAL TRAINING | |
| Year | 2010. |
| Place | Zagreb |
| Institution | Faculty of the Chemical Engineering and Technology |
| Field of training | Processes of seeded crystallization |
| Year | 2005. |
| Place | Rome |
| Institution | L'Universita degli Studi di Roma ˝La Sapienza˝ |
| Field of training | Batch cooling crystallization processes |
| 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 |
| 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) | Unit Operations - undergraduate study of Chemical Technology<br>Material and Energy Balances- undergraduate study of Chemical Technology |
| Authorship of university/faculty textbooks in the field of the course | |
| Professional, scholarly and artistic articles published in the last five | A. Kaćunić, **M. Ćosić**, N. Kuzmanić, Impact of mixing parameters on homogenization of borax solution and nucleation |

| | |
|---|---|
| years in the field of the course (5 works at most) | rate in dual radial impeller crystallizer, *International journal of chemical, molecular, nuclear, materials and metallurgical engineering,* 10 (2016) 1; 75-80.<br>A. Kaćunić, **M. Akrap**, N. Kuzmanić, Effect of impeller position in a batch cooling crystallizer on the growth of borax decahydrate crystals, *Chemical engineering research & design*. 91, 2; (2013), 274-285.<br>**M. Akrap**, N. Kuzmanić, J. Prlić Kardum, Impeller geometry effect on crystallization kinetics of borax decahydrate in a batch cooling crystallizer, *Chemical engineering research & design*. 90, 6; (2012), 793-802<br>**M. Akrap**, N. Kuzmanić, J. Prlić Kardum, Effect of mixing on the crystal size distribution of borax decahydrate in a batch cooling crystallizer, *Journal of crystal growth*, 312, 24 (2010); 3603-3608.<br>**M. Akrap**, D. Bralić, N. Kuzmanić, In-line bulk concentration measurement in batch cooling crystallization of borax decahydrate, *Proceedings of the 13th Ružićka Days ˝ Today science - tomorrow industry˝*, Osijek, 2011, 115-125 |
| 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 011-0112247-2241:<br>Optimization of mixing and transport phenomena in solid-liquid agitated systems<br>Scientific project - Impact of processing conditions on kinetics of heterogeneous systems in agitated batch reactors, HRZZ-8959 (2014.-2018.) |
| 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) | Evaluation organizer: University of Split<br><br>Courses:<br>Unit operations: Av. Grade:>4.0<br>Material and energy balances: Av. Grade:>4.0<br>Mechanical and heat transfer operations: Av. Grade:>4.5 |

| | |
|---|---|
| First and last name and title of teacher | **PhD, Pero Dabić, prof.** |
| The course he/she teaches in the proposed study programme | New inorganic materials<br>Non-metallic composites<br>Solidification and Stabilization Processes |
| GENERAL INFORMATION ON COURSE TEACHER | |
| Address | Ruđera Boškovića 35, 21000 Split |

| | |
|---|---|
| Telephone number | 00385 21 329 470 |
| E-mail address | dabic@ktf-split.hr |
| Personal web page | - |
| Year of birth | 1962. |
| Scientist ID | 181084 |
| Research or art rank, and date of last rank appointment | Scientific adviser (26 September 2013) |
| Research-and-teaching, art-and-teaching or teaching rank, and date of last rank appointment | Full professor (First choice, 21 May 2015) |
| 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 | 19 March 1990 |
| Name of position (professor, researcher, associate teacher, etc.) | full professor |
| Field of research | inorganic technology |
| Function | |
| INFORMATION ON EDUCATION – Highest degree earned | |
| Degree | Ph. D. (chemical engineering) |
| Institution | Faculty of Chemistry and Technology, University of Split |
| Place | Split |
| Date | 03 April 2004 |
| INFORMATION ON ADDITIONAL TRAINING | |
| Year | 1991 (Training for thermal analysis); 2007 (The 1st Croatian Synchrotron Radiation Summer School) |
| Place | Rapperswil, Swiss ; Rijeka-Trst, Croatia-Italy |
| Institution | Laboratory Perkin-Elmer ; Electra-Trst |
| Field of training | Thermal analysis; Synchrotron Radiation- nanostructured materials |
| 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) | 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) | Nanostructured materials (post doctoral study_ Chemical Engineering in Materials Development and Environmental Protection) |
| 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) | • D. Barbir, P. Dabić, A. Lisica, Assessment of the leachability and mechanical stability of mud from a zinc-plating plant and waste zeolite binding with portland cement, International journal of research in engineering and technology. 3 (2014), Special Issue 13; 37-42. |

| | |
|---|---|
| | • D. Barbir, P. Dabić, P. Krolo, Hydration Study of Ordinary Portland Cement in the Presence of Lead(II) Oxide, CABEQ, 27 (2013) 95-99.<br>• D. Barbir, P. Dabić, P. Krolo, Stabilization of chromium salt in ordinary portland cement, SADHANA-Academy Proceedings in Engineering Sciences, 37 (2012) 731-737.<br>• D. Barbir, P. Dabić, P. Krolo, Evaluation of leaching behavior and immobilization of zinc in cement-based solidified products, Hem. Ind. 66 (2012) 781-786.<br>• N. Ukrainczyk, P. Dabić, T. Matusinović, Calcium aluminate cement hydration model, Kemija u industriji. 60 (2011) 1-10. |
| 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 | • Rector's Award for achievement in the study of academic year 1983-84.<br>• Acknowledgement of the Association of Engineers of Split (ZUIS) on the occasion of the 100th anniversary of the outstanding contribution development of technical profession and the economy in general |
| 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, Matko Erceg, associate prof.** |
| The course he/she teaches in the proposed study programme | Polymerization Processes<br>Structure and Properties of Polymers<br>Polymer Processing<br>Recycling of Plastics |
| GENERAL INFORMATION ON COURSE TEACHER | |
| Address | Ruđera Boškovića 35, 21000 Split, Croatia |
| Telephone number | ++385 21 329 457 |
| E-mail address | merceg@ktf-split.hr |

| | |
|---|---|
| Personal web page | https://www.ktf-split.hr/index.php/obavijesti-2/obavijesti-poslijediplomski-studij/172-djelatnici/cv/174-cv46 |
| Year of birth | 1976. |
| Scientist ID | 243566 |
| Research or art rank, and date of last rank appointment | Senior researcher, 26. 9. 2013. |
| Research-and-teaching, art-and-teaching or teaching rank, and date of last rank appointment | Associate professor, 17. 7. 2012. |
| Area and field of election into research or art rank | Area: Technical Sciences; Field: Chemical Engineering |
| INFORMATION ON CURRENT EMPLOYMENT | |
| Institution where employed | Faculty of Chemistry and Technology, University of Split |
| Date of employment | 1. 2. 2001. |
| Name of position (professor, researcher, associate teacher, etc.) | Associate professor |
| Field of research | Polymer engineering |
| Function | Associate professor |
| INFORMATION ON EDUCATION – Highest degree earned | |
| Degree | Ph.D. |
| Institution | Faculty of Chemistry and Technology |
| Place | Split |
| Date | 17. 5. 2007. |
| INFORMATION ON ADDITIONAL TRAINING | |
| Year | 2007. |
| Place | Lyon, France |
| Institution | Institut de Recherches sur le Catalyse et l'Environnement de Lyon |
| Field of training | Thermal analysis methods in chemical engineering |
| 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 (excellent) |
| Foreign language and command of foreign language on a scale from 2 (sufficient) to 5 (excellent) | German; 2 (sufficient) |
| 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. Plastics and Rubber Processing, Undergraduate study Chemical Technology<br>2. Catalysis, Undergraduate study Chemical Technology |
| 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. Jakić, N. Stipanelov Vrandečić, **M. Erceg**, Kinetic analysis of the non-isothermal degradation of poly(vinyl chloride)/poly(ethylene oxide) blends, Journal of Thermal Analysis and Calorimetry 123 (2016) 1513-1522.<br>2. **M. Erceg**, D. Jozić, I. Banovac, S. Perinović, S. Bernstorff, Preparation and characterization of melt intercalated poly(ethylene oxide)/lithium montmorillonite, Thermochimica acta 579 (2014) 86-92.<br>3. **M. Erceg**, D. Jozić, Preparation and characterization of poly(3-hydroxybutyrate)/Cloisite25A nanocomposites, e-polymers 025 (2013) 1-12. |

| | |
|---|---|
| | 4. **M. Erceg**, L. Kurte, M. Kursan, Influence of recycling on thermal properties and kinetics of thermal degradation of polypropylene, Plastic and Rubber Journal 32 (2011) 74-80. |
| 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. Scientific project 'Polymer blends with biodegradable components' (011-1252971-2249) financed by the Ministry of Science, Education and Sports of Republic of Croatia<br>2.Scientific project 'Development of biocomposites reinforced with cellulose fibers from domestic resources, (Faculy of textile technology, University of Zagreb)<br>3. Innovation project: 'Possibility of waste usage in production of bitumen waterproofing ' in cooperation with Hidroizolacija Katra d.o.o. Zagreb, financed by the Croatian Agency for SMEs, Innovation and Investments (HAMAG BICRO) |
| 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) | Evaluation organizer: University of Split<br>Average grade: Plastics and Rubber Processing 4.8<br>Average grade: Catalysis 4.8 |

| | |
|---|---|
| First and last name and title of teacher | **PhD, Ivana Generalić Mekinić, assistant prof.** |
| The course he/she teaches in the proposed study programme | Processes in Food Industry<br>Grape processing<br>Citrus processing |
| GENERAL INFORMATION ON COURSE TEACHER | |
| Address | Ruđera Boškovića 33, 21000 Split |
| Telephone number | + 385 21/329 458 |
| E-mail address | gene@ktf-split.hr |
| Personal web page | https://tkojetko.irb.hr/znanstvenikDetalji.php?sifznan=20205 |
| Year of birth | 1984. |
| Scientist ID | 298955 |
| Research or art rank, and date of last rank appointment | Research associate, 13.07.2012. |
| Research-and-teaching, art-and-teaching or teaching rank, and date of last rank appointment | Assistant professor, 30.10.2014. |
| Area and field of election into research or art rank | Biotechnical Sciences, Food Technology |
| INFORMATION ON CURRENT EMPLOYMENT | |

| | |
|---|---|
| Institution where employed | Faculty of Chemistry and Technology, University of Split |
| Date of employment | 01.11.2007. |
| Name of position (professor, researcher, associate teacher, etc.) | Assistant professor |
| Field of research | Teaching, Science |
| Function | Assistant professor, researcher |
| INFORMATION ON EDUCATION – Highest degree earned | |
| Degree | Ph.D. |
| Institution | Faculty of Food Technology and Biotechnology, University of Zagreb |
| Place | Zagreb |
| Date | 12.10.2012. |
| INFORMATION ON ADDITIONAL TRAINING | |
| Year | 2009/2010 |
| Place | Ljubljana, Slovenia |
| Institution | Biotechnical faculty, University of Ljubljana |
| Field of training | Food chemistry and microbiology |
| 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 (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) | Teacher and practice assistant of several courses:<br>Pregraduate level:<br>Single Processes in Food Industry (KTF204);<br>Grape Processing (KTF205)<br>Graduate level (before Bologna process):<br>Chemistry and Technology of Grapes and Wines |
| Authorship of university/faculty textbooks in the field of the course | Laboratory practice handbooks:<br>„Grape Processing “ and "Technology of the Mediterranean fruit and vegetable" |
| Professional, scholarly and artistic articles published in the last five years in the field of the course (5 works at most) | Skroza, D., Generalić Mekinić I., Svilović, S., Šimat, V., Katalinić, V. Investigation of the potential synergistic effect of resveratrol with other phenolic compounds: A case of binary phenolic mixtures. Journal of Food Composition and Analysis. 38 (2015) 13-18.<br>Ristovski, B., Doneva Sapceska, D., Generalic Mekinic, I., Skroza, D., Ljubenkov, I., Katalinic, V., Bocevska, M. Influence of medical plant phenolic extracts on color evolution in anthocyanin extracts under different light conditions during storage. Journal of Hygienic Engineering and Design. 6 (2014) 102-111.<br>Mudnić, I., Budimir, D., Modun, D., Gunjača, G., Generalić, I., Skroza, D., Katalinić, V., Ljubenkov, I., Boban, I. Antioxidant and vasodilatory effects of blackberry and grape wines. Journal of Medicinal Food. 15 (2012) 3, 315-321.<br>Katalinić, V., Smole Možina, S., Skroza, D., Generalić, I., Abramovič, H., Miloš, M., Ljubenkov, I., Piskernik, S., Pezo, I., Terpinc, P., Boban, M. Polyphenolic profile, antioxidant |

| | |
|---|---|
| | properties and antimicrobial activity of grape skin extracts of 14 Vitis vinifera varieties grown in Dalmatia (Croatia). Food Chemistry. 119 (2010) 2, 715-723.<br>Generalić Mekinić, I., Gotovac, M., Skroza, D., Ljubenkov, I., Burčul, F., Katalinić, V. Effect of the extraction solvent on the oleuropein content and antioxidant properties of olive leaf (cv. Oblica, Lastovka and Levantinka) extracts. Croatian Journal of Food Science and Technology, 6 (2014) 1, 7-14. |
| 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) | Bilateral project "Enhancment of the stability and the bioaviailability of selected phytochemicals using different delivery systems and mathematical modeling of an in vitro digestion model" (Croatia-Serbia) (2016-2018).<br>Bilateral project "Effect of medicinal plant phenolic extracts on the stability of grape antocyanins" (Croatia-Macedonia) (2012-2014).<br>International education project "Improvement Academia-Industry Link sin Food Safety and Quality" 158714-TEMPUS-1-2009-1-ES-TEMPUS-JPHE<br>National scientific project 011-2160547-2226: „Natural sources of resveratrol and its synergic effect with other polyphenols" (2007-2013).<br>Bilateral project "Natural, biologically active additives for healthy and stable food" (Croatia-Slovenia) (2009-2011). |
| 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 | 2011.- Biotechnical support, Faculty of Food Technology and Biotechnology, Zagreb<br>2011.- Faculty of Chemistry and Technology reward for young scientist<br>2010.- CEFood 2010 Congress, Bratislava- Award for the best oral presentation in the category of the young scientist section |
| 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 | Quality Assurance of Food |
| 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 organisation of laboratories, graduate study chemistry<br>Analytical chemistry, Professional Study of Chemical Technology<br>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,<br>J. Giljanović, Analysis of food products: instructions for exercises, professional studies, food technology<br>J. Giljanović, Ensuring food quality: guidelines for exercise, professional studies, food technology<br>J. Komljenović, Exercises in analytical chemistry, reviewed material for students of university study biology and ecology, 2004th<br>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;<br>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.<br>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.<br>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.<br>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 Aránteguí Jiminéz ) Split, 2011. str: 76-81; 85-90;91-103;;<br>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, Senka Gudić, prof.** |
| The course he/she teaches in the proposed study programme | Electrochemical methods and their application<br>Corrosion inhibitors<br>Direct energy conversion |
| GENERAL INFORMATION ON COURSE TEACHER | |
| Address | Ruđera Boškovića 35, 21000 Split |
| Telephone number | ++385 21 329 433 |
| E-mail address | senka@ktf-split.hr |
| Personal web page | |
| Year of birth | 1965. |
| Scientist ID | 181062 |
| Research or art rank, and date of last rank appointment | Senior Research Scientist - May 12th, 2009. |
| Research-and-teaching, art-and-teaching or teaching rank, and date of last rank appointment | Full Professor - July 25, 2011. |
| 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 | November 2nd, 1990. |
| Name of position (professor, researcher, associate teacher, etc.) | Full Professor |
| Field of research | Analysis, synthesis and management of chemical processes |
| Function | |
| INFORMATION ON EDUCATION – Highest degree earned | |
| Degree | PhD |
| Institution | Faculty of Chemistry and Technology, University of Split |
| Place | Split |
| Date | June 21st, 2000. |
| 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. Electrochemistry, Chemical sources of energy – undergraduate study of Chemical Technology (orientation: Chemical Engineering)<br>2. Electrochemical engineering, Direct energy conversion – professional study of Chemical Technology (orientation: Chemical Technology and Materials)<br>3. Electrochemical engineering, Corrosion inhibitors – postgraduate doctoral study Chemical Engineering in Materials Development and Environmental Protection |
| Authorship of university/faculty textbooks in the field of the course | 1. **S. Gudić**, Elektrokemijski izvori struje, KTF-Split, 2011.<br>2. **S. Gudić**, Inhibitori korozije metala, KTF-Split, 2006. |
| Professional, scholarly and artistic articles published in the last five years in the field of the course (5 works at most) | 1. **S. Gudić**, L. Vrsalović, M. Kliškić, A. Radonić, M. Zekić, I. Jerković, Corrosion inhibition of AA 5052 aluminium alloy in 0.5 M NaCl solution by different types of honey, Int. J. Electrochem. Sci. 11 (2016) 998-1011.<br>2. L. Vrsalović, **S. Gudić**, M. Kliškić, E. Oguzie, L. Carev, Inhibition of Copper Corrosion in NaCl Solution by Caffeic Acid, Int. J. Electrochem. Sci. 11 (2015) 459-474.<br>3. **S. Gudić,** A. Radonić, E.E. Oguzie, L. Vrsalović, I. Smoljko, M. Kliškić, Cofeine as corrosion inhibitor for Cu in NaCl solution, **Maced. J. Chem. Chem. Eng. 33 (2014) 13-25.**<br>4. I. Smoljko**, S. Gudić**, N. Kuzmanić, M. Kliškić, Anodic behaviour of aluminium alloys in NaCl solution, J. App. Electrochem. 42 (2012) 969-977.<br>5. M. Gojić, L. Vrsalović, S. Kožuh, A.C. Kneissl, I. Anžel, **S. Gudić**, B. Kosec, M. Kliškić, Electrochemical and microstructural study of Cu-Al-Ni shape memory alloy, J. Alloy. Compd. **506** (2011) **9782-9790.** |
| 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, Igor Jerković, prof.** |

| | |
|---|---|
| The course he/she teaches in the proposed study programme | Chemistry and Technology of Aromatic Plants |
| GENERAL INFORMATION ON COURSE TEACHER | |
| Address | N. Tesle 10/V, HR-21000 Split |
| Telephone number | 021 329 436 |
| 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 | Science adviser (25.10.2012.) |
| Research-and-teaching, art-and-teaching or teaching rank, and date of last rank appointment | Full professor (04.12.2013.) |
| 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, Split |
| Date of employment | 01. 09. 1998. |
| Name of position (professor, researcher, associate teacher, etc.) | professor |
| Field of research | Chemistry |
| Function | Vice dean for science and international cooperation |
| INFORMATION ON EDUCATION – Highest degree earned | |
| Degree | Ph. D. |
| Institution | Faculty of Chemistry and Technology, Split |
| Place | Split |
| Date | 28. 05. 2004. |
| INFORMATION ON ADDITIONAL TRAINING | |
| Year | 2005 |
| Place | Rome |
| Institution | Dipartimento di Chimica dell' Università di Roma "La Sapineza |
| Field of training | Chemistry of 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 and Aroma Chemistry (graduated study of Chemistry, Faculty of Chemistry and Technology Split) |
| Authorship of university/faculty textbooks in the field of the course | Aroma Chemistry, Faculty of Chemistry and Technology, Split, 2011. |
| Professional, scholarly and artistic articles published in the last five years in the field of the course (5 | 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 |

| | |
|---|---|
| works at most) | Product Communications 8 (2013) 231-233.<br>I. Jerković, M. Šuste, Ž. Maleš and K. Hazler Pilepić, Essential Oil Composition of Prasium majus from Croatia, Natural Product Communications 7 (2012) 931-932.).<br>I. Jerković, D. Gašo-Sokač, H. Pavlović, Z. Marijanović, M. Gugić, I. Petrović and S. Kovač, Volatile Organic Compounds from Centarium erythraea Rafn (Croatia) and Unlocking Antibacterial Activity of its Essential Oil, Molecules 17 (2012) 2058-2072.<br>Other published papers |
| 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 MZOS „Essential oils and aromas –biologically active compounds and their modifications“ |
| 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 | Award for science achievements „Ruđer Bošković“, University of Split, 29. 11. 2013.<br>Award for special achievements in scientific work and teaching, Faculty of Chemistry and Technology, Split, 22. 10. 2011<br>Award "Leopold (Lavoslav) Ružička" Croatian Chemical Society for remarkable results in the area of chemistry of natural compounds, Zagreb, 19. 10. 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) | Evaluation organizer: University of Split<br>Chemistry and technology of aromatic plants: Average Grade: 4.9<br>Aroma Chemistry: Average Grade: 4.9 |

| | |
|---|---|
| First and last name and title of teacher | **PhD, Dražan Jozić, associate prof.** |
| The course he/she teaches in the proposed study programme | The technology of building materials |
| GENERAL INFORMATION ON COURSE TEACHER | |
| Address | Teslina 10/V, 21000 Split |
| Telephone number | 021-329-471 |
| E-mail address | jozicd@ktf-split.hr |
| Personal web page | https://www.ktf-split.hr/index.php/odsjekzainzenjertvoitehnologije-3/zat/172-hrvatski/djelatnici/cv/155-drazanjozic |
| Year of birth | 1974. |
| Scientist ID | 231234 |
| Research or art rank, and date of | Senior research scientist, 26.12.2013. |

| | |
|---|---|
| last rank appointment | |
| Research-and-teaching, art-and-teaching or teaching rank, and date of last rank appointment | PhD, Associated professor, 29.05.2013. |
| Area and field of election into research or art rank | Area: Technical Sciences, Field: Chemical Engineering |
| INFORMATION ON CURRENT EMPLOYMENT | |
| Institution where employed | Faculty of Chemistry and Technology |
| Date of employment | 01.07.2003. |
| Name of position (professor, researcher, associate teacher, etc.) | Associated professor |
| Field of research | Chemical Engineering in the developing a materials |
| Function | Member of the Department |
| INFORMATION ON EDUCATION – Highest degree earned | |
| Degree | PhD |
| Institution | Faculty of Chemistry and Technology |
| Place | Split |
| Date | 20.07.2007. |
| INFORMATION ON ADDITIONAL TRAINING | |
| Year | 2004. |
| Place | Monza, Italy |
| Institution | Perkin Elmer |
| Field of training | Training for maintaining, adjusting and properly operation of the instrument for thermogravimetric measurements with simultaneous differential thermal analysis (TG / DTA) model Perkin Elmer Pyris Diamond |
| Year | 2011. |
| Place | Planneralm, Austria |
| Institution | Institut für Physik, Montanauniversität Leoben, Austria |
| Field of training | Application Synchrotron and Neutron radiation in the purpose of Characterization different type of materials |
| Year | 2010.-2011. |
| Place | Trieste, Italy |
| Institution | Elettra-Sincrotrone Trieste S.C.p.A. |
| Field of training | Application Synchrotron radiation in the different instrumental techniques and experimental methods of recording at Austrian SAXS beamline such as of Small Angles X-ray Scattering at (SAXS), Grazing-Incidence Small-Angle X-ray Scattering (GISAXS) and Wide-Angle X-ray Scattering (WAXS, XRD). in the purpose of developing materials in engineering materials especially nanostructured materials. |
| Year | 2014. |
| Place | Bari, Italy |
| Institution | Institute of Crystallography-CNR of Bari |
| Field of training | Methods of resolving structure of crystal from the powder pattern and methods for solution structure of crystal and refinement applied on monocrystal sistems by using programs SIR/EXPO 2014 |
| 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) | Minerals binders, Professional studies: Chemical Technology and Materials, level 5<br>Process in the Inorganic Industry, Professional studies: Chemical Technology and Materials, level 5 |
| 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. D. Jozić, S. Zorica, D. Tibljaš, S. Bernstorff, Insitu SAXS/WAXS study of the developing process of geopolymer structures, 15th European Conference on Composite Materials, Venice, Italy, 2012, pp.1-8., USB disk<br>2. Mužek, Mario Nikola; Zelić, Jelica; Jozić, Dražan, Microstructural Characteristics of Geopolymers Based on Alkali-Activated Fly Ash, Chemical and Biochemical Engineering Quartely. 26 (2012) , 2; 89-95.<br>3. Jozić, Dražan; Lučić-Lavčević, Magdy; Erceg, Matko; Perinović, Sanja; Bernstorff, Sigrid, Simultaneous insitu SAXS/WAXS study of processes and products of geopolymerization, Proceedings of the 15th International Small-Angle Scattering Conference, Sydney, Australia, 2012.<br>4. D. Jozić, M. Martinović, S. Bernstorff, Kinetics of cement hydration of type CEM I 42.5R without and with replacement addition of fly ash, Slovenian-Italian Conference on Materials and Technologies for Sustainable Growth, Proceedings book, M.Valant, S. Gardonio, E. Fabbretti and U. Pirnat (Eds.), University of Nova Gorica, Slovenia, 2011, pp.19-24.<br>5. D. Jozić, I. Knezovića, S. Bernstorff, Kinetics of cement hydration with replacement addition of fly ash into aqueous suspension systems, International conference on materials, tribology, recycling, Proceedings, Z. Schauperl, S. Šolić (Eds.), Croatian Society for Materials and Tribology, Vela Luka, 2011, pp.159-167. |
| 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. Scientific project in the framework of CERES Research Felowship: The study of processes and products of geopolymerisation by using SAXS/WAXS, Project leader: PhD Dražan Jozić, (from 01.10.2010.to 01.10.2011.)<br>2. Scientific project (Beamtime Project) Nr. 20115315, In-situ characterization of the developing microstructure in geopolymers under different experimental preparation conditions by simultaneous SAXS/WAXS/IR |

| | |
|---|---|
| | measurements, Project leader: PhD Dražan Jozić, (24.05-06.06.2012.) |
| 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 | CEI Research Fellowship Programme (CERES) (Marie Currie/FP7) |
| 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, Maja Kliškić, prof.** |
| The course he/she teaches in the proposed study programme | Electrochemical Engineering<br>Corrosion and Materials Protection |
| GENERAL INFORMATION ON COURSE TEACHER | |
| Address | Teslina 10/V, 21000 Split |
| Telephone number | ++385 329 435 |
| E-mail address | mkliskic@ktf-split.hr |
| Personal web page | |
| Year of birth | 1953. |
| Scientist ID | 119820 |
| Research or art rank, and date of last rank appointment | Senior Research Scientist - April 21st, 2006. |
| Research-and-teaching, art-and-teaching or teaching rank, and date of last rank appointment | Full Professor - permanent position - July 25, 2011. |
| 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 | December 1st, 1982. |
| Name of position (professor, researcher, associate teacher, etc.) | Full Professor - permanent position |
| Field of research | Analysis, synthesis and management of chemical processes |
| Function | Head of Department of Electrochemistry and Materials Protection |
| INFORMATION ON EDUCATION – Highest degree earned | |
| Degree | PhD |
| Institution | Faculty of Chemistry and Technology, University of Split |
| Place | Split |
| Date | October 28th, 1994. |
| 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 |
| 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. Electrochemical Engineering - Undergraduated study of Chemical Technology;<br>2. Electrochemical Engineering - postgraduate doctoral study Chemical Engineering in Materials Development and Environmental Protection. |
| Authorship of university/faculty textbooks in the field of the course | M. Kliškić, Elektrokemijsko inženjerstvo, recenzirana skripta, Kemijsko-tehnološki fakultet, Split, 2006. |
| Professional, scholarly and artistic articles published in the last five years in the field of the course (5 works at most) | 1. L. Vrsalović, S. Gudić, M. Kliškić, Maja, E.E. Oguzie, Carev, Luka, Inhibition of Copper Corrosion in NaCl Solution by Caffeic Acid, International Journal of Electrochemical Science; 11 (2015.), 459-474.<br>2. 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, Macedonian Journal of Chemistry and Chemical Engineering. **33** (2014.); 1, 13-25.<br>3. B. Lalić**,** M. Kliškić, I. Komar, Analiza korozijskog djelovanja u cilindru brodskoga sporohodnoga dvotaktnog dizelskog motora, Znanstveno-stručni časopis za more i pomorstvo "Naše more", 60 (2013.), (1/2); 8-15.<br>4. L. Vrsalović, S. Gudić, M. Kliškić, Salvia officinalis L. honey as corrosion inhibitor for CuNiFe alloy in sodium chloride solution, Indian journal of chemical technology, 19 (2012.); 2, 96-102.<br>5. L. Vrsalović, E.E. Oguzie, M. Kliškić, S. Gudić, Corrosion inhibition of CuNi10Fe alloy with phenolic acids, Chemical engineering communications. 198 (2011.); 11, 1380-1393. |
| 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, Nada Krstulović, prof.** |
| The course he/she teaches in the proposed study programme | Microbiology of polluted waters |
| GENERAL INFORMATION ON COURSE TEACHER | |
| Address | Split, Setaliste I. Mestrovica 140 |
| Telephone number | 021 358295 |
| E-mail address | krstulovic@izor.hr |
| Personal web page | |
| Year of birth | 1949 |
| Scientist ID | 024065 |
| Research or art rank, and date of last rank appointment | Senior research scientist - 06.05.2003. |
| Research-and-teaching, art-and-teaching or teaching rank, and date of last rank appointment | Full professor - 28.10.2005. |
| Area and field of election into research or art rank | Natural sciences; biology |
| INFORMATION ON CURRENT EMPLOYMENT | |
| Institution where employed | |
| Date of employment | |
| Name of position (professor, researcher, associate teacher, etc.) | |
| Field of research | Marine Microbiology and Microbial Ecology |
| Function | |
| INFORMATION ON EDUCATION – Highest degree earned | |
| Degree | Senior research scientist |
| Institution | Institute of Oceanography and Fisheries |
| Place | Split |
| Date | 06.05.2003. |
| INFORMATION ON ADDITIONAL TRAINING | |
| Year | 1979, 1982 |
| Place | Aberdeen (Scotland) |
| Institution | Marine Institute |
| Field of training | Microbial Ecology |
| MOTHER TONGUE AND FOREIGN LANGUAGES | |
| Mother tongue | Croatian |
| Foreign language and command of | English 4 |

| | |
|---|---|
| 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) | |
| 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) | *General Microbiology*, University Department for Marine Studies, University of Split<br><br>*Marine Microbiology*, University Department for Marine Studies, University of Split<br><br>*Microbiological processes in the marine environment and Marine pollution*, Postgraduated PhD Study „Applied Marine Sciences“, University of Split, University of Dubrovnik, Institute of Oceanography and Fisheries, Split<br><br>*Marine Bacteriology*, Interdisciplinary Doctoral Study in Oceanology,<br>University of Zagreb, Ruđer Bošković Institute, Zagreb and Rovinj, Institute Of Oceanography and Fisheries, Split, Institute for Marine and Coastal Research of University in Dubrovnik. |
| Authorship of university/faculty textbooks in the field of the course | **Krstulović, N**. i M. Šolić, 2006. Mikirobioologija mora, Institut za oceanografiju i ribarstvo,317 p. Udžbenici Sveučilišta u Splitu.<br><br>Šolić, M., **N. Krstulović,** 2000. Ekologija morskog bakterioplanktona. Institut za oceanografiju i ribarstvo,Split. 452 p.<br><br>Šolić, M., **N. Krstulović**, S. Šestanović, D. Šantić, N. Bojanić, M. Ordulj, S. Jozić. 2016. Microbial Community Ecology of the Adriatic Sea (Šolić, M., N. Krstulović, eds.). LAP Lambert Academic Publishing, Saarbrücken, Germany, 436 p. |
| Professional, scholarly and artistic articles published in the last five years in the field of the course (5 works at most) | Šolić, M., **N. Krstulović**, D. Šantić, S. Šestanović, M. Ordulj, N. Bojanić, G. Kušpilić. 2015. Structure of microbial communities in phosphorus-limited estuaries along the eastern Adriatic coast. *Journal of Marine Biology Association U.K.,* **95**: 1565-1578. doi:10.1017/S0025315415000442.<br><br>Redžić, A., **N. Krstulović**, M. Šolić, D. Šantić, M. Ordulj. 2015. Dynamics of prokaryotic community in Boka Kotorska Bay (South-eastern Adriatic Sea). *Acta Adriatica*, 56: 157-170.<br><br>Ordulj, M**., N. Krstulović**, D. Šantić, S. Jozić, M. Šolić. 2015. Distribution of marine viruses in the Central and South Adriatic Sea. *Mediterranean Marine Science*. 16: 65-72 DOI: http://dx.doi.org/10.12681/mms.911<br><br>Jozić, S., M. Morović, M. Šolić**, N. Krstulović**, M. Ordulj. 2014. Effect of solar radiation, temperature and salinity on the survival of two different strains of *Escherichia coli*. *Fresenius Environmental Bulletin*, **23**: 1852-1859. |

| | |
|---|---|
| | Šantić, D., **N. Krstulović**, M. Šolić, M. Ordulj, G. Kušpilić. 2013. Dynamics of prokaryotic picoplankton community in the central and southern Adriatic Sea (Croatia). *Helgoland Marine Research*, **67**: 471-481.<br><br>**Krstulović, N**., M. Šolić, D. Šantić, J. Maršić-Lučić, M. Ordulj, S. Šestanović. 2013. Microbial community structure in two anchialine caves on Mljet Island (Adriatic Sea). *Acta Adriatica*, **54**: 183-198.<br><br>https://bib.irb.hr/ |
| 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) | Associate in Project "Marine microbial food web processes in global warming perspective"(MICROGLOB) IP-2014-09-4143 (2015-2018).<br><br>Leader of the Project of the Ministry of Science of the Republic of Croatia: „The role of plankton communities in the energy and matter flux in the Adriatic Sea " (001-0013077-0845). (2006-2014).<br><br>Leader of the Subtask WP5 in Project: „Policy-oriented marine environmental research in the Southern European Seas" (PERSEUS). 2012-2016. Funding source: EU-FP7<br><br>Leader of the Project *Characteristics of good environmental status (GES) and environmental targets for the marine environment under sovereignty of the Republic of Croatia"*. Ministry of Environmental and Nature Protection, 2013-2014.<br><br>Leader of the Project „Initial assessment of the state and pressures on Croatian part of the Adriatic Sea" Ministry of Environmental and Nature Protection, 2011-2012. |
| 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? | Study of Biology at the Faculty of Natural Science and Mathematics, University of Zagreb (1968-1973)<br><br>Inaugural lecture in front of the Commission as a condition for appointment to academic title of Assistant Professor<br><br>Over 20 years experience in teaching at the undergraduate, graduate and postgraduate levels |
| PRIZES AND AWARDS, STUDENT EVALUATION | |
| Prizes and awards for teaching and scholarly/artistic work | The award of the city of Split (group award) as a member of the science team IOF for the achievements in scientific research of the Kaštela Bay (1991)<br><br>Award of the Croatian Academy of Sciences and Arts (HAZU) for the highest achievements in the Republic of Croatia in the field of natural sciences and mathematics (2006) |
| Results of student evaluation taken | Average grade (form 1 – 5) = 4.8-5 |

| | |
|---|---|
| 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, Lea Kukoč Modun, assistant prof.** |
| The course he/she teaches in the proposed study programme | Instrumental methods of analysis |
| GENERAL INFORMATION ON COURSE TEACHER | |
| Address | Hrvatske mornarice 1 K, Split |
| Telephone number | 098706693 |
| E-mail address | kukoc@ktf-split.hr |
| Personal web page | - |
| Year of birth | 1977. |
| Scientist ID | 250621 |
| Research or art rank, and date of last rank appointment | Research associate, 30.03.2012. |
| Research-and-teaching, art-and-teaching or teaching rank, and date of last rank appointment | Assistant professor, 30.12.2012. |
| Area and field of election into research or art rank | Natural sciences, chemistry, analytical chemistry |
| INFORMATION ON CURRENT EMPLOYMENT | |
| Institution where employed | Faculty of chemistry and technology |
| Date of employment | 01.02.2002. |
| Name of position (professor, researcher, associate teacher, etc.) | Assistant professor |
| Field of research | analytical chemistry |
| Function | /// |
| INFORMATION ON EDUCATION – Highest degree earned | |
| Degree | Ph:D. |
| Institution | Faculty of Chemical Engineering and Technology |
| Place | Zagreb |
| Date | 16.10.2009. |
| INFORMATION ON ADDITIONAL TRAINING | |
| Year | 2004. |
| Place | Monza, Italy |
| Institution | Centar Perkin-Elmer |
| Field of training | Atomic absorption spectrometry |
| Year | 2005. |
| Place | Graz, Austria |
| Institution | Karl-Franzens Universitat |
| Field of training | Electroanalytical methoda |
| 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 | German, 3 |

| | |
|---|---|
| (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) | Analytical chemistry I, Undergraduate Study, Chemistry<br>Analytical chemistry II, Undergraduate Study, Chemistry<br>Analytical chemistry I, Study of Pharmacy<br>Analytical chemistry II, Study of Pharmacy<br>Instrumental methods of analysis in pharmacy, Study of Pharmacy |
| Authorship of university/faculty textbooks in the field of the course | 1. Radić, Njegomir; Kukoč Modun, Lea; Introduction to Analytical Chemistry Školska knjiga, Zagreb, 2016. (*In press*).<br>2. Radić, Njegomir; Kukoč Modun, Lea; Introduction to Analytical Chemistry Part I ; Split : Redak, 2013<br>3. Radić, Njegomir; Kukoč Modun, Lea; Kinetic Methods of Analysis with Potentiometric and Spectrophotometric Detectors – Our Laboratory Experiences // Analytical Chemistry / Ira S. Krull (ur.).; Rijeka : InTech, 2012. Str. 73-92. |
| Professional, scholarly and artistic articles published in the last five years in the field of the course (5 works at most) | 1. L. Kukoc-Modun, D. Tsikas, M. Biocic, Nj. Radić, Flow Injection Analysis of *N*-acetyl-L-cysteine based on the reduction of copper(II)-neocuproine reagent, *Analytical Letters*, 49 (2016) 607-617.<br>2. Lejla Klepo, Amira Copra-Janicijevic, Lea Kukoc-Modun, A New Indirect Spectrofluorimetric Method for Determination of Ascorbic Acid with 2,4,6-Tripyridyl-S-Triazine in Pharmaceutical Samples, *Molecules*, 21(1), (2016) 101-<br>3. Radić, Njegomir; Kukoc-Modun, Lea; Biočić, Maja; Kinetic Spectrophotometric Determination of *N*-acetyl-L-cysteine based on the reduction of copper(II)-neocuproine reagent; *Croatica chemica acta*. 86 (2013) 65-71<br>4. Kukoc-Modun, Lea; Biočić, Maja; Radić, Njegomir; Indirect method for spectrophotometric determination of ascorbic acid in pharmaceutical preparations with 2, 4, 6-tripyridyl-s-triazine by flow-injection analysis; *Talanta*. 96 (2012) 174-179<br>5. Kukoc-Modun, Lea; Plazibat, Ivana; Radić, Njegomir; Flow-injection spectrophotometric determination of *N*-Acetyl-L-cysteine based on coupled redox-complexation reaction; *Croatica chemica acta*. 84 (2011) 81-85 |
| 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 011-0000000-3217: «Determination of tiol compounds using potentiometric sensors and spectroscopy ». MZOS RH from 2007. to 2013., collaborator |
| 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 | University Educational Course of Educators, gained knowledge from the following areas of education: methods of teaching, team learning, PBL, Microteaching, Communication skils, Searching of scientific databases. |
| PRIZES AND AWARDS, STUDENT EVALUATION | |
| Prizes and awards for teaching and scholarly/artistic work | Award for the Hot article in journal Analytical Sciences: “Kinetic Spectrophotometric Determination of N-acetyl-L-cysteine Based on Coupled Redox-Complexation Reaction” |
| 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, Nenad Kuzmanić, prof.** |
| The course he/she teaches in the proposed study programme | Environmental Engineering<br>Separation Processes |
| GENERAL INFORMATION ON COURSE TEACHER | |
| Address | Teslina 10/V, 21000 Split |
| Telephone number | ++385 21 329 468 |
| E-mail address | kuzmanic@ktf-split.hr |
| Personal web page | |
| Year of birth | 1959. |
| Scientist ID | 120556 |
| Research or art rank, and date of last rank appointment | Scientific Adviser- March 27th, 2007 |
| Research-and-teaching, art-and-teaching or teaching rank, and date of last rank appointment | Full Professor - June 17th, 2012 |
| 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 | December 1st, 1984 |
| Name of position (professor, researcher, associate teacher, etc.) | Full Professor |
| Field of research | Mechanical, thermal and separation processes |
| Function | Head of Department of chemical engineering |
| INFORMATION ON EDUCATION – Highest degree earned | |
| Degree | PhD |
| Institution | Faculty of Chemistry and Technology, University of Split |
| Place | Split |
| Date | December 26th, 1995 |
| INFORMATION ON ADDITIONAL TRAINING | |
| Year | 1991.-1992. |
| Place | Torino, Italy |
| Institution | Politecnico di Torino, Dipartimento di Scienza dei Materiali e Ingegneria Chimica, Torino, Italy |
| Field of training | Solid suspension in mixing vessels; wall sampling of solid suspension from mixing tank |
| Year | 2000.-2001. |
| Place | Rolla, Missouri, USA |
| Institution | University of Missouri - Rolla, Department of Chemical Engineering, Rolla , Missouri, USA |
| Field of training | Mixing in multiphase systems |
| 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 | Italian (5) |

| | |
|---|---|
| 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) | Material and energy balances – undergraduated study of Chemical Technology<br>Introduction to chemical engineering– undergraduated study of Chemistry<br>Mechanical and heating operations – graduated study of Chemical Technology (orientation: Materials)<br>Environmental engineering - graduated study of Chemical Technology (orientation: Environmental protection) |
| 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) | A. Kaćunić, M. Akrap, **N. Kuzmanić**, Effect of impeller position in a batch cooling crystallizer on the growth of borax decahydrate crystals, Chemical engineering research & design. 91 (2013) 2; 274-285.<br>M. Akrap, **N. Kuzmanić**, J. Prlić Kardum, Impeller geometry effect on crystallization kinetics of borax decahydrate in a batch cooling crystallizer, Chemical engineering research & design. 90 (2012) 6; 793-802.<br>I. Smoljko, S. Gudić, **N. Kuzmanić**, M. Kliškić, Electrochemical properties of aluminium anodes for Al/air batteries with aqueous sodium chloride electrolyte, Journal of applied electrochemistry. 42 (2012) 11; 969-977.<br>M Akrap, **N. Kuzmanić**, J. Prlić-Kardum, Effect of mixing on the crystal size distribution of borax decahydrate in a batch cooling crystallizer, Journal of crystal growth. 312 (2010) , 24; 3603-3608.<br>**N. Kuzmanić**, R. Žanetić, M. Akrap, Impact of floating suspended solids on the homogenisation of the liquid phase in dual-impeller agitated vessel, Chemical Engineering & Processing. 47 (2008) 4; 663-669. |
| 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 011-0112247-2241: Optimization of mixing and transport phenomena in solid-liquid agitated systems (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? | |
| PRIZES AND AWARDS, STUDENT EVALUATION | |
| Prizes and awards for teaching and scholarly/artistic work | University of Missouri - Rolla Award, Rolla, Missouri, USA |
| 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, Miroslav Labor, associate prof.** |
| The course he/she teaches in the proposed study programme | Marine and submarine and mineral raw materials |
| GENERAL INFORMATION ON COURSE TEACHER | |
| Address | Ruđera Boškovića 35, 21000 Split |
| Telephone number | 021/329-478 |
| E-mail address | miroslav.labor@ktf-split.hr |
| Personal web page | |
| Year of birth | 1963. |
| Scientist ID | 199731 |
| Research or art rank, and date of last rank appointment | Research scientist, 26th November 2013. |
| Research-and-teaching, art-and-teaching or teaching rank, and date of last rank appointment | Associate professor, 18th July 2014. |
| Area and field of election into research or art rank | Area -Technical Sciences, Field - Chemical Engineering |
| INFORMATION ON CURRENT EMPLOYMENT | |
| Institution where employed | Faculty of Chemistry and Technology, University of Split |
| Date of employment | 25th February 1992. |
| Name of position (professor, researcher, associate teacher, etc.) | Associate professor in Department of Thermodynamics |
| Field of research | Research and Highly Education |
| Function | Employer representative for occupational safetly (2000.- 2016.), Specialist occupational safetly (2016. - ) |
| INFORMATION ON EDUCATION – Highest degree earned | |
| Degree | Ph. D. in the Scientific Area of Technical Sciences, Field of Chemical Engineering, Branch of Analysis, Synthesis and Conducting of Chemical Processes |
| Institution | Faculty of Chemistry and Technology |
| Place | Split |
| Date | 15th February 2008. |
| 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) | Conducted laboratory exercises (base level) in:<br>**Marine and Submarine Raw Materials** on:<br>- Undergraduated University Study Programm in Chemical Technology, Study Orientation: Technology of Sea and Mediterranean plants from 1993. to 2002.,<br>- Undergraduated University Study Programm in Chemical Technology, Study Orientation: Chemistry and Technology of Mediterranean plants from 2002. to 2005.,<br>- Academic Graduate Study of Chemical Technology, Study Orientation: Materials from 2008. - .<br>**Seawater as Sources of Mineral Raw Materials** on:<br>Academic Undergraduate Study of Chemical Technology, Study Orientation: Chemical Engineering from 2005.to 2014. |
| Authorship of university/faculty textbooks in the field of the course | V. Martinac, **M. Labor**, Seawater as Sources of Mineral Raw Materials, (on line 2011-01-18), Laboratory exercises, Internal mimeographed notes, (in Croatian), Faculty of Chemistry and Technology, Split, 2011. |
| Professional, scholarly and artistic articles published in the last five years in the field of the course (5 works at most) | 1. J. Jakić, I. Martić, **M. Labor**, V. Martinac,<br>The effect of the rinsing agent in treatment of seawater-derived magnesium hydroxide precipitate, Proceedings of the International Conference MATRIB 2015, Materials, Wear, Recycling, D. Ćorić, I. Žmak (Eds.), Croatian Society for Materials and Tribology, Zagreb, 2015., 166-176.<br><br>2. **M. Labor**, I. Bajić, J. Jakić, V. Martinac, Rinsing the magnesium hydroxide precipitate obtained from seawater, Proceedings MATRIB 2014, Electronic Edition , S. Šolić, M. Šnajdar Musa (Eds.), Croatian Society for Materials and Tribology, Zagreb, 2014., 271-278.<br><br>3. **M. Labor**, M. Perić, J. Jakić, V. Martinac, Sintering of magnesium oxide obtained from seawater at 1600 $^{o}$C, Proceedings of the 10th International Scientific-Research Symposium, Electronic Edition , S. Muhamedagić (Ed.), University of Zenica, Faculty of Metallurgy and Materials Science, Zenica, 2014., 277-283.<br><br>4. **M. Labor**, M. Tolo, V. Martinac, J. Jakić,<br>The MgO (80% precipitation) from seawater, Proceedings of the International Conference on Materials, Processes, Friction and Wear, MATRIB 2013, Ž. Alar, S. Jakovljević, S. Šolić (Eds.), Croatian Society for Materials and Tribology, Zagreb, 2013., 248-254.<br><br>5. **M. Labor**, V. Martinac, N. Petric, $B_2O_3$ content in the sintered magnesium oxide obtained from seawater, Indian journal of chemical technology, **20** (2013) 276-281 |
| 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, Magdy Lučić Lavčević, associate prof.** |
| The course he/she teaches in the proposed study programme | Nanotechnology and Environment<br>Ionization Radiation in Biosphere |
| 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.<br>1997/1998/2003. |
| Place | Zagreb<br>Zagreb, Basovizza |
| Institution | Faculty of Natural Sciences<br>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<br><br>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<br><br>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<br>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, Ivica Ljubenkov, assistant prof.** |
| The course he/she teaches in the proposed study programme | Olives processing |
| GENERAL INFORMATION ON COURSE TEACHER | |
| Address | Cesta F. Tuđmana 228, 21212 Kaštel-Sućurac |
| Telephone number | 021/224-331 |
| E-mail address | ivica.ljubenkov4@gmail.com |
| Personal web page | |
| Year of birth | 1958 |
| Scientist ID | 185946 |
| Research or art rank, and date of last rank appointment | Research associate, 03.06.2011. |
| Research-and-teaching, art-and-teaching or teaching rank, and date of last rank appointment | Assistant professor (13.07.2011) |
| Area and field of election into research or art rank | Chemistry, Analytical chemistry |
| INFORMATION ON CURRENT EMPLOYMENT | |
| Institution where employed | Faculty of science, University of Split |
| Date of employment | 07.04.2010. |
| Name of position (professor, researcher, associate teacher, etc.) | Assistant professor |
| Field of research | Analytical chemistry |
| Function | |
| INFORMATION ON EDUCATION – Highest degree earned | |
| Degree | Dr.sc. |
| Institution | Faculty of science, University of Zagreb |
| Place | Zagreb |
| Date | 03.03.2000. |
| 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) | Olive processing, graduate level KTD202<br>Olive processing, pregraduate level KTF213 |
| Authorship of university/faculty textbooks in the field of the course | Olive processing technologies, Laboratory procedure (internal document) |
| Professional, scholarly and artistic | 1. Generalić Mekinić, Ivana; Gotovac, Marko; Skroza, Danijela; |

| | |
|---|---|
| articles published in the last five years in the field of the course (5 works at most) | Ljubenkov, Ivica; Burčul, Franko; Katalinić, Višnja, Effect of the extraction solvent on the oleuropein content and antioxidant properties of olive leaf (cv. Oblica, Lastovka and Levantinka) extracts, *Croatian Journal of Food Science and Technology*. 6 (2014), 1; 7-14.<br>2. Generalić, I.; Agić, P.; Skroza, D.; Ljubenkov, I.; Matek Sarić, M.; Režić Dereani, V. Antioxidant properties of Oblica cv olive oil phenolics, *Book of Abstracts of the 7th International Congress of food technologists, biotechnologists, and nutritionists* / Medić, Helga (ur.). Zagreb : BARIS d.o.o., Zaprešić, 2011. 116-116.<br>3. Ljubenkov, I.; Skroza, D.; Generalić, I.; Konta, I.; Čagalj, Ž.; Veličković, V.; Petričević, S.,,Physical, chemical and sensory properties of Dalmatian olive oils, *Book of Abstracts of the 7th International Congress of food technologists, biotechnologists, and nutritionists* / Medić, Helga (ur.). Zagreb: BARIS d.o.o., Zaprešić, 2011. 236-236.<br>4. Šimić, A., Graovac, A., Ljubenkov, I. Monitoring Dynamics of Croatian Olive Fields and Vineyards using Remote Sensing Applications; MATH/CHEM/COMP 2009: The Dubrovnik International Course & Conference on the Interfaces among Mathematics, Chemisty and Computer Sciences. Inter-University Centre, Dubrovnik, Croatia, June 8-13, 74. ISBN 978-953-6954-51-3.<br>5. Ljubenkov, I. Olive oil: Technology, Chemistry and Health MATH/CHEM/COMP 2009: The Dubrovnik International Course & Conference on the Interfaces among Mathematics, Chemisty and Computer Sciences. Inter-University Centre, Dubrovnik, Croatia, June 8-13, 48. ISBN 978-953-6954-513. |
| 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. Programme of support the scientific research projects in agriculture of Split-Dalmatia County for 2013: „Enzymes of lipoxygenase parhway in indigenous varieties of olives“, 10.12.2013., Klasa: 402-01/13-01/1655, URBROJ: 2181/1-05-00-02/02-13-0003. |
| 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, Jadranka Marasović, prof.** |
| The course he/she teaches in the proposed study programme | Process Automatic Control |
| GENERAL INFORMATION ON COURSE TEACHER | |
| Address | Split, Zagrebačka 21 |
| Telephone number | 385 021 305 830 (institution) |
| E-mail address | jmar@fesb.hr |
| Personal web page | / |
| Year of birth | 1955. |
| Scientist ID | 080633 |
| Research or art rank, and date of last rank appointment | Senior Research Scientist, 09. July 2007. |
| Research-and-teaching, art-and-teaching or teaching rank, and date of last rank appointment | Full professor, 01. March 2009. |
| Area and field of election into research or art rank | Technical science, field of electrical engineering |
| INFORMATION ON CURRENT EMPLOYMENT | |
| Institution where employed | Faculty of Electrical Engineering, Machine Engineering and Naval Architecture, University of Split |
| Date of employment | 04. May 1978. |
| Name of position (professor, researcher, associate teacher, etc.) | Professor |
| Field of research | Science and Education |
| Function | / |
| INFORMATION ON EDUCATION – Highest degree earned | |
| Degree | Doctor of science |
| Institution | Faculty of Electrical Engineering, Machine Engineering and Naval Architecture, University of Split |
| Place | Split |
| Date | 11. 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 (excellent -5) |
| Foreign language and command of foreign language on a scale from 2 (sufficient) to 5 (excellent) | Italian (sufficient-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 | **Undergraduate studies:** |

| | |
|---|---|
| where it is/was offered, and level of study programme) | Mjerenje i vođenje procesa (Measurements and Process Control),<br><br>Simulacijsko modeliranje (Simulation Modelling),<br><br>Automatizacija industrijskih procesa (Industrial Process Control)<br><br>**Graduate studies:**<br><br>Automatsko reguliranje procesa (Automatic Control),<br><br>Identifikacija sustava (System Identification),<br><br>Praktikum iz vođenja procesa (Process Control Laboratory Exercises)<br><br>Metode optimizacije (Optimization Methods),<br><br>Automatizacija (Automation)<br><br>**Postgraduate study:**<br><br>Optimization Techniques for Environmental Studies (Wessex Institute of Tecnology, UK i FESB) |
| Authorship of university/faculty textbooks in the field of the course | - (autor) Kvantitativno i kvalitativno modeliranje i simuliranje (Quantitative and Qualitative Modelling and Simulation) ( ISBN 953-6114-67-4),<br>- (koautor) On-line (web) udžbenik, Informatički projekt MZT-a, http://laris.fesb.hr/digitalno_vodjenje (Digital Control)<br>- (autor) Predavanja iz kolegija Metode optimizacije (Lessons for Optimizaion Methods) (FESB, e-learning).<br>- (autor) Predavanja iz kolegija Modeliranje i simuliranje sustava (Lessons for Modelling and Simulations) (FESB, e-learning). |
| Professional, scholarly and artistic articles published in the last five years in the field of the course (5 works at most) | - Marasović, Tea; Papić, Vladan; **Marasović, Jadranka**. *Motion-based Gesture Recognition Algorithms for Robot Manipulation*. // International Journal of Advanced Robotic Systems. 12 (2015), 51; 1-13, doi: 10.5772/60077.<br>- **Marasović, Jadranka**; Marasović, Tea; Đapić, Marija. *Fair Division Methods Approach as the Option of Learning Process Modeling*. // Proceedings of 18th IEEE International Symposium on Computers and Communications (ISCC). 2013; 735-739.<br>- Mance, Davor; **Marasović, Jadranka**. *EMC in Electronic System Developed to Support Measurements in Space Environment*. // Proceedings of 20th International Conference on Software, Telecommunications and Computer Networks (SoftCOM). 2012; 1-5. |
| 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) | Suradnica na projektima:<br>- Računalna inteligencija za prepoznavanje i potporu ljudskih aktivnosti (RIPrePAkt),<br>- GRS Front End Electronics Characterization for LISA,<br>- Agentski orijentirani inteligentni sustavi za nadzor i zaštitu okoliša (Agents Oriented Intelligent Systems for Environment Control and Protection),<br>- Inteligentni agenti u modeliranju i vođenju kompleksnih sustava (Intelligent Agents used for Complex Systems Modelling and Control),<br>- Vođenje složenih sustava inteligentnim metodama (Intelligent Methods for Complex Systems Control). |
| 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, Jasna Maršić Lučić, associate prof.** |
| The course he/she teaches in the proposed study programme | Ecotoxicology |
| GENERAL INFORMATION ON COURSE TEACHER | |
| Address | Šetalište I. Meštrovića 63. 21000 Split |
| Telephone number | + 385 21 408 000 |
| E-mail address | jmarsic@izor.hr |
| Personal web page | |
| Year of birth | 1961 |
| Scientist ID | 158781 |
| Research or art rank, and date of last rank appointment | Senior scientific associate, 20.2.2014 |
| Research-and-teaching, art-and-teaching or teaching rank, and date of last rank appointment | Associate professor, 6.5.2011 |
| Area and field of election into research or art rank | Biotechnical science, Biotechnology |
| INFORMATION ON CURRENT EMPLOYMENT | |
| Institution where employed | Institute of oceanography and fisheries Split |
| Date of employment | 9.6.1988 - |
| Name of position (professor, researcher, associate teacher, etc.) | Senior researcher |

| | |
|---|---|
| Field of research | Aquaculture |
| Function | researcher |
| INFORMATION ON EDUCATION – Highest degree earned | |
| Degree | PhD |
| Institution | Faculty of food technology and biotechnology |
| Place | Zagreb |
| Date | 15.12.1995 |
| INFORMATION ON ADDITIONAL TRAINING | |
| Year | 2010 |
| Place | Split |
| Institution | Institute Of Oceanography and fisheries / Universite Pierre et Marie Curie, Banylus-sur mer ; France |
| Field of training | Molecular Phylogeny |
| Year | 2003 |
| Place | Zagreb |
| Institution | Institute "Ruđer Bošković", |
| Field of training | Biochemistry/Genetics |
| Year | 1994. |
| Place | Montpellier, France |
| Institution | Laboratory for genetics and environment University of Montpellier II, Montpellier, |
| Field of training | Population genetics |
| Year | 1990 |
| Place | Split |
| Institution | Institute Of Oceanography and fisheries/ FAO/IOC/UNEP |
| Field of training | Statistical treatment and data interpretation in sea 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 5 |
| Foreign language and command of foreign language on a scale from 2 (sufficient) to 5 (excellent) | France 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) | University of Split, University center for sea studies, Split, (Marine fisheries and Marine biology and ecology) : Undergraduate and Graduate studies: lectures: Ecotoxicology, Biotechnology and genetics in fisheries and aquaculture; Population genetics of the sea organisms<br><br>Postgraduate: University of Split (Interuniversitary postgraduate university study of applied marine sciences), lectures: Population dynamic of the sea organisms, and Micobiological and toxicological aspects of seafood hygene<br><br>Faculty of chemistry and technology,University of Split: Chemical technology graduate studies: lectures: Ecotoxicology |
| 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 | Krstulović, Nada; Šolić, Mladen; Šantić, Danijela; Maršić-Lučić, Jasna; Ordulj, Marin; Šestanović, Stefanija. Microbial community structure in two anchialine caves on Mljet Island |

| | |
|---|---|
| works at most) | (Adriatic Sea). Acta Adriatica. 54 (2013) , 2; 183-198.<br><br>Šimat, Vida; Bogdanović, Tanja; Krželj, Maja; Soldo, Alen; Maršić Lučić, Jasna. (2012).Differences in chemical, physical and sensory properties during shelf life assessment of wild and farmed gilthead sea bream (Sparus aurata, L.). // Journal of Applied Ichthyology. 28:95-101.<br><br>Šimat, Vida; Soldo, Alen; Maršić-Lučić, Jasna; Tudor, Mladen; Bogdanović, Tanja. (2009). Effect of different storage conditions on dielectric properties of the sea bass (Dicentrarchus labrax). Acta Adriatica. 50(1) 5-10.<br><br>Šimat, Vida; Maršić-Lučić, Jasna; Tudor, Mladen; Mladineo, Ivona. (2009)<br>Long-term storage influence on volatile amines (TVB-N and TMA-N) in sardine and herring utilized as food for tuna fattening. Journal of Applied Ichthyology. 25:766-770.<br><br>Maršić-Lučić, Jasna; Tudor, Mladen; Šćekić, Vida. 2008. Effect of defrosting on quantity of volatile amines in stored sardine and herring used for tuna feed. Journal of Applied Ichthyology:24(1): 81-84. |
| 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) | 2015- AQUAPOP- the impact of aquaculture on the environment<br>2013- Biology and genetic characterization of new species in aquaculture<br>2011-2013. Determination of the genetic structure of natural populations of native species of interest to fisheries and aquaculture along eastern Adriatic coast<br>2008-2013. Dynamic and pathology of parasitofauna in reared marine fish systems;<br>2006-2009. SUSTAINAQ (Sustainable aquaculture production through the use of recirculation systems; EU FP6. |
| 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, Vanja Martinac, prof.** |
| The course he/she teaches in the proposed study programme | Thermodynamics of Real Processes |
| GENERAL INFORMATION ON COURSE TEACHER | |
| Address | Ruđera Boškovića 35, 21000 Split |
| Telephone number | 00385 21 329 447 |
| E-mail address | martinac@ktf-split.hr |
| Personal web page | - |
| Year of birth | 1959. |
| Scientist ID | 119805 |
| Research or art rank, and date of last rank appointment | Senior Research Scientist – 21st April 2006. |
| Research-and-teaching, art-and-teaching or teaching rank, and date of last rank appointment | Full professor (with tenure ) – 25th July 2011. |
| Area and field of election into research or art rank | Area – Technical Sciences, Field – Chemical Engineering |
| INFORMATION ON CURRENT EMPLOYMENT | |
| Institution where employed | Faculty of Chemistry and Technology |
| Date of employment | 04th June 1984. |
| Name of position (professor, researcher, associate teacher, etc.) | Full professor (with tenure ) in Department of Thermodynamics |
| Field of research | Research and Highly Education |
| Function | Head of Department of Thermodynamics (1998.- ) |
| INFORMATION ON EDUCATION – Highest degree earned | |
| Degree | Ph. D. of Technical Sciences in the Field of Chemical Engineering |
| Institution | Faculty of Technology University of Split |
| Place | Split |
| Date | 08th July 1994. |
| INFORMATION ON ADDITIONAL TRAINING | |
| Year | Croatian |
| Place | English (3) |
| Institution | |
| Field of training | |
| MOTHER TONGUE AND FOREIGN LANGUAGES | |
| Mother tongue | |
| 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) | |
| 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) | **Technical Thermodynamics** (base level) on:<br>- Undergraduated University Study Programm in Chemical Technology from 1996. to 2005.,<br>- Professional Study of Chemical Technology (Study Orientation: Chemical Technology and Food Technology) 2001. and 2002.<br>**Thermodynamics** (base level) on: |

| | |
|---|---|
| | - Undergraduated University Study Programm in Chemical Technology, Study Orientation: Chemistry and Technology of Mediterranean plants from 2002. to 2005.,<br>- Academic Undergraduate Study of Chemical Technology, Study Orientation: Chemical Engineering and Enviromental Protection from 2005.<br>- Academic Undergraduate Study of Food Technology from 2016.<br>**Thermodynamics and Thermotechnics** (base level) on:<br>- Professional Study of Chemical Technology (Study Orientation: Process Technology and Food Technology) from 2002. to 2005.,<br>- Professional Study of Chemical Technology (Study Orientation: Chemical Technology and Materials, and Food Technology) from 2005.-2015.<br>- Proffesional Study of Materials protection and recycling from 2016.<br>- Professional Study of Food Technology on Polytechnic of Knin "Marko Marulić" from 2005. to 2012.<br>**Thermodynamics of Real Processes** (base level) on:<br>- Undergraduated University Study Programm in Chemical Technology, Study Orientation: Chemical Technology Processes from 1998. to 2006.<br>- Academic Graduate Study of Chemical Technology, Study Orientation: Materials and Enviromental Protection from 2008.<br>**Chemical Engineering Thermodynamics** (advanced level) on:<br>- Postgraduated Study in "Chemical Engineering in Materials Development", acad. year 2004./05.<br>- Postgraduated Doctoral Study in "Chemical Engineering in Materials Development and Enviromental Protection", acad. year 2008./09. i 2012./13. |
| Authorship of university/faculty textbooks in the field of the course | 1. N. Petric, I. Vojnović, **V. Martinac**, Technical Thermodynamics, University book, (in Croatian), 1st Ed., Hinus, Zagreb 1999.<br>2. N. Petric, I. Vojnović, **V. Martinac**, Technical Thermodynamics, University book, (in Croatian), 2nd Ed., Faculty of Chemistry and Technology, on line (2007-01-09), Split, 2007.<br>3. N. Petric, I. Vojnović, **V. Martinac**, Technical Thermodynamics, University book, (in Croatian), 3rd Ed., Redak, Split, 2015.<br>4. N. Petric, **V. Martinac**, Chemical Engineering Thermodynamics, (Thermodynamics of Real Processes), Internal faculty textbook, (in Croatian), Faculty of Technology, Split, 1998.<br>5. **V. Martinac**, Chemical Engineering Thermodynamics, Internal faculty textbook, (in Croatian), Faculty of Chemistry and Technology, Split, 2008.<br>6. **V. Martinac**, J. Jakić, Thermodynamics (Laboratory Exercises), on line (2011-11-15), Internal mimeographed notes, (in Croatian), Faculty of Chemistry and Technology, Split, 2010. |
| Professional, scholarly and artistic articles published in the last five years in the field of the course (5 | 1. M. Labor, **V. Martinac**, N. Petric, $B_2O_3$ content in the sintered magnesium oxide obtained from seawater, Ind. J Chem. Technol., **20** (2013) 276-281. |

| | |
|---|---|
| works at most) | 2. **V. Martinac**, Effect of $TiO_2$ Addition on the Sintering Process of Magnesium Oxide from Seawater, Sintering of Ceramics - New Emerging Techiques, A. Lakshmanan (Ed.), Rijeka, InTech, 2012., 309-322. |
| 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 011-0112247-2250 "Acitivated Sintering of Magnesium Oxide", Ministry of Science, Education and Sports of the Republic of Croatia, (2007.-2013.); Principal Investigator: Prof. Ph. D. V. Martinac |
| 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, Mirko Marušić, senior 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, | senior lecturer |

| | |
|---|---|
| researcher, associate teacher, etc.) | |
| 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<br>Undergraduate programme of Music art of Composition<br>Art academy, University of Split<br>• Physics<br>Professional study – Chemical technology and materials<br>Professional study – Food technology<br>Professional study – Materials protection and recycling<br>Undergraduate study - Food technology<br>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.<br>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.<br>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).<br>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.<br>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<br>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 articles published in the last five years in the field of the course (5 works at most) | 1. S. Ivankovic, R. Stojkovic, Z. Galic, B. Galic, J. Ostojic, M. 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.<br>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.<br>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.<br>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.<br>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<br><br>- 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<br>Graduate study in chemistry<br>Integrated undergraduate and graduate study of Pharmacy<br>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<br>Biochemistry average grade: 4,6<br>Introduction in biochemistry average grade: 4,8<br>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 | Biochemistry |
| GENERAL INFORMATION ON COURSE TEACHER | |
| Address | Ruđera Boškovića 35, Split |
| 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 articles published in the last five years in the field of the course (5 works at most) | Siracusa Laura, Kulišić-Bilušić Tea, **Politeo Olivera,** Krause 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.<br><br>**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.<br><br>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.<br><br>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.<br><br>**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.<br><br>"Antioxidant compounds and cholinesterase inhibitors from aromatic plants" (011-2160547-1330), Ministry of Science, Croatia, 2008 -2014.<br><br>"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).<br>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, Ani Radonić, associate prof.** |
| The course he/she teaches in the proposed study programme | Perfumes and Cosmetics |
| GENERAL INFORMATION ON COURSE TEACHER | |
| Address | Ruđera Boškovića 35, 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, | Associate Professor |

| | |
|---|---|
| researcher, associate teacher, etc.) | |
| Field of research | Natural organic compounds:<br>• 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).<br>• Glycosidically bound volatile compounds - water-soluble, non-volatile aroma precursors: methods of isolation, purification and hydrolvsis (enzymatic, acid); identification of aglycones by GC-MS.<br>• 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.<br>• 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), $\beta$-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 14$^{th}$, 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 | 1. Undergraduate study of Chemistry:<br>Organic Chemisry I, Organic Chemistry II, Natural Products, Perfumes and Cosmetics |

| | |
|---|---|
| study programme) | 2. Graduate study of Chemistry<br>Synthesis of Biologically Active Compounds<br>3. Graduate study of Pharmacy:<br>Organic Chemistry I, Organic Chemistry II,<br>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.<br>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.<br>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.<br>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.<br>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.<br>• 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 |
| 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 | • Reaction Engineering (Undergraduate study of chemical |

| | |
|---|---|
| teacher of similar courses (name title of course, study programme where it is/was offered, and level of study programme) | engineering)<br>• 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).<br>• 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.<br>• 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.<br>• 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, Mirjana Skočibušić, associate prof.** |
| The course he/she teaches in the proposed study programme | General 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.<br><br>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.<br><br>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.<br><br>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.<br><br>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 | Indicators of fecal contamination and possible pathogens in coastal areas (177-0000000-3182) 2008 – 2013. |

| | |
|---|---|
| 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? | 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 grading scale and course evaluated) | Regular surveys of quality of teaching which is carried out by the University of Split. Ratings have been very positive. |

| | |
|---|---|
| First and last name and title of teacher | **PhD, Ivana Smoljko, assistant prof.** |
| The course he/she teaches in the proposed study programme | Solid Waste and Recycling |
| GENERAL INFORMATION ON COURSE TEACHER | |
| Address | Faculty of chemistry and technology, Ruđera Boškovića 35, 21000 Split |
| Telephone number | +385 021 329 444 |
| E-mail address | ismoljko@ktf-split.hr |
| Personal web page | http://bib.irb.hr/lista-radova?autor=267183 |
| Year of birth | 1977. |
| Scientist ID | 267183 |
| Research or art rank, and date of last rank appointment | Research associate, 21 March 2011 |
| Research-and-teaching, art-and-teaching or teaching rank, and date of last rank appointment | Assistant professor, 5 February 2014 |
| Area and field of election into research or art rank | Technical sciences, Chemical engineering |
| INFORMATION ON CURRENT EMPLOYMENT | |
| Institution where employed | University of Split, Faculty of chemistry and technology |
| Date of employment | 1 May 2004 |
| Name of position (professor, researcher, associate teacher, etc.) | Assistant professor |
| Field of research | Chemical engineering, Analysis**,** synthesis, and design of chemical processes |
| Function | |
| INFORMATION ON EDUCATION – Highest degree earned | |
| Degree | Ph.D. |
| Institution | University of Split, Faculty of chemistry and technology |
| Place | Split |
| Date | 30 April 2010 |
| INFORMATION ON ADDITIONAL TRAINING | |

| | |
|---|---|
| Year | 2014 |
| Place | Split |
| Institution | University of Split, Faculty of Humanities and Social Sciences |
| Field of training | Development and improvement of pedagogical competencies of university teachers |
| | |
| Year | 2007 |
| Place | Rijeka, First Synchrotron Radiation Summer School "Syncro 07" |
| Institution | University of Rijeka |
| Field of training | Natural sciences, Physics |
| | |
| Year | 2006 |
| Place | Palić, 4th European Summer School on Electrochemical Engineering “ESSEE 4“ |
| Field of training | Technical sciences, Chemical engineering |
| 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 |
| 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) | • Solid Waste and Recycling (Graduate Study of Chemical Technology, Orientation: Materials and Orientation: Environmental Protection)<br>• Solid Waste and Recycling (Professional Study of Chemical Technology, Orientation: Chemical technology and materials) |
| 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. *L. Vrsalović, T. Paić, V. Alar, I. Stojanović, S. Jakovljević, S. Gudić,* ***I. Smoljko***, The effects of surface treatment AISI 316L welded joints on its corrosion behaviour in chloride solution, Kovové materiály **54** (2016) 211-215.<br>2. *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, Macedonian Journal of Chemistry and Chemical Engineering **33** (2014) 13-25.<br>3. ***I. Smoljko****, B. Jejina, S. Gudić, M. Kliškić, N. Kuzmanić,* Dobivanje vodika uporabom aluminijske ambalaže, Zbornik radova MATRIB 2013, Ž. Alar, S. Jakovljević, S. Šolić (ur.), Hrvatsko društvo za materijale i tribologiju, Zagreb, 2013. 356-366.<br>4. ***I. Smoljko****, S. Gudić, N. Kuzmanić, M. Kliškić*, Electrochemical properties of aluminium anodes for Al/air batteries with aqueous sodium chloride electrolyte, Journal of applied electrochemistry **42** (2012) 969-977. |
| 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) | Optimization of mixing and transport phenomena in solid-liquid agitated systems (011-0112247-2241) |

| | |
|---|---|
| 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? | Development and improvement of pedagogical competencies of university teachers (University of Split, Faculty of Humanities and Social Sciences) |
| PRIZES AND AWARDS, STUDENT EVALUATION | |
| Prizes and awards for teaching and scholarly/artistic work | • 2012 University of Split Faculty of Chemistry and Technology Dean's Recognition Award for Creativity Activity<br>• 2010 University of Split Award for the Best Presentation<br>• 2001 University of Split Rector's Award to the Best Students at University of Split<br>• 1999 University of Split Faculty of Chemistry and Technology Award for Exceptional Achievements During Study |
| 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, Nataša Stipanelov Vrandečić, prof.** |
| The course he/she teaches in the proposed study program | Characterization of Polymers<br>Coatings<br>Packaging |
| GENERAL INFORMATION ON COURSE TEACHER | |
| Address | Ruđera Boškovića 35, 21 000 Split, Croatia |
| Telephone number | 00385 21 329 459 |
| E-mail address | nstip@ktf-split.hr |
| Personal web page | http://tkojetko.irb.hr/znanstvenikDetalji.php?sifznan=7463 |
| Year of birth | 1966. |
| Scientist ID | 226264 |
| Research or art rank, and date of last rank appointment | Senior Research Scientist, 2010-4-27 |
| Research-and-teaching, art-and-teaching or teaching rank, and date of last rank appointment | Full Professor, 2015-10-29 |
| Area and field of election into research or art rank | Area: Technical Sciences; Field: Chemical Engineering |
| INFORMATION ON CURRENT EMPLOYMENT | |
| Institution where employed | Faculty of Chemistriy and Technology |
| Date of employment | 1995-06-01 |
| Name of position (professor, researcher, associate teacher, etc.) | Associated Professor |
| Field of research | Chemical Engineering in Materials Development |
| Function | Vice dean |
| INFORMATION ON EDUCATION – Highest degree earned | |
| Degree | Dr. Sc. |
| Institution | Faculty of Chemistry and Technology |
| Place | Split |

| | |
|---|---|
| Date | 2003-3-28 |
| 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) | Technological processes in organic industry, Academic Undergraduate Study of Chemical Technology, Study Orientations: Chemical Engineering<br>Processes in Organic Industry, Professional Study of Chemical Technology; Study Orientations: Chemical Technology and Materials<br>Coatings, Professional Study of Chemical Technology; Study Orientations: Chemical Technology and Materials<br>Packaging, Professional Study of Chemical Technology; Study Orientations: Food Technology |
| 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. Jakić, N. Stipanelov Vrandečić and I. Klarić, Thermal degradation of poly(vinyl chloride)/poly(ethylene oxide) blends: Thermogravimetric analysis, Polymer Degradation and Stability 98 (2013) 1738-1743<br>2. N. Stipanelov Vrandečić, M. Erceg, M. Jakić and I. Klarić, Kinetic analysis of thermal degradation of poly(ethylene glycol) and poly(ethylene oxide)s of different molecular weight, Thermochimica Acta 498 (2010) 71-80<br>3. M. Jakić, N. Stipanelov Vrandečić, I. Klarić, Utjecaj poli(etilen-glikola) na toplinsku razgradnju mješavina poli(vinil-klorid)/poli(etilen-oksid) International Conference on Materials, Tribology, Recycling - MATRIB 2013, Zagreb: Hrvatsko društvo za materijale i tribologiju, Vela Luka, 2013. str. 192-203<br>4. M. Erceg, M. Omazić, N. Stipanelov Vrandečić, I. Banovac: Preparation and characterization of poly(ethylene oxide)/lithium montmorillonite composites, 15th European Conference On Composite Materials, Venecija, Italija, 2012. |
| 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 | Scientific project 011-1252971-2249: Polymer Blends with Biodegradable Components (2007-2013) |

| | |
|---|---|
| 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 | Award of the Society of Plastics and Rubber for master's thesis in the field of polymeic technology (2001-12-4). |
| 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, Sandra Svilović, associate prof.** |
| The course he/she teaches in the proposed study programme | Chemical reactors |
| GENERAL INFORMATION ON COURSE TEACHER | |
| Address | Ruđera Boškovića 35 |
| Telephone number | ++385 21 329 431 |
| E-mail address | sandra@ktf-split.hr |
| Personal web page | |
| Year of birth | 1974 |
| Scientist ID | 237630 |
| Research or art rank, and date of last rank appointment | Research scientist - May 27th, 2013 |
| Research-and-teaching, art-and-teaching or teaching rank, and date of last rank appointment | Associate professor - 24.09.2015 |
| 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 | June 1st, 2000 |
| Name of position (professor, researcher, associate teacher, etc.) | Associate professor |
| Field of research | Reaction engineering |
| Function | |
| INFORMATION ON EDUCATION – Highest degree earned | |
| Degree | PhD |
| Institution | Faculty of Chemistry and Technology, University of Split |
| Place | Split |
| Date | July 23rd, 2009 |
| INFORMATION ON ADDITIONAL TRAINING | |
| Year | 2003 |
| Place | Split |
| Institution | Faculty of Science, University of Split |

| | |
|---|---|
| Field of training | Software Mathematica |
| 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) | Chemical reactors - professional study of chemical technology |
| 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) | S. Svilović, M. Jakovčević, R. Stipišić, D. Rušić, Equilibrium studies of copper cations exchange by synthetic zeolite X, International conference MATRIB 2013, Vela Luka (2013) 368-373<br>M.N. Mužek, S. Svilović, J. Zelić, Fly ash-based geopolymeric adsorbent for copper ion removal from wastewater, Desalination and Water Treatment, 52 (2014) 2519-2526. Z. Zeković S Filip, S. Vidović, S. Jokić, S. Svilović, Mathematical modeling of Ocimum basilicum L. supercritical carbon dioxide extraction, Chemical Engineering & Technology 37 (2014) 2123-2128.<br>M. Trgo, N. Vukojević Medvidović, J. Perić, S. Svilović, G. Čačija, Influence of zeolite particle size and initial lead concentration on sorption kinetic study by batch experiments, The Holistic Approach to Environment, 5 (2015) 105-118.<br>M. N. Mužek, S. Svilović, M. Ugrina, J. Zelić, Removal of copper and cobalt ions by fly ash-based geopolymer from solutions - equilibrium study, Desalination and Water Treatment, 57 (2016) 10689-10699. |
| 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 011-0112247-2245<br>Chemical engineering in examination of mariculture<br><br>HRZZ Research Projects (IP-11-2013-4981)<br>Impact of processing conditions on kinetics of heterogeneous systems in agitated batch reactors (HETMIX) |
| 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, Vida Šimat, assistant prof.** |
|---|---|
| The course he/she teaches in the proposed study programme | Seafood processing technology |
| GENERAL INFORMATION ON COURSE TEACHER | |
| Address | Livanjska 5/3, 21000 Split |
| Telephone number | +385 21 558 254 |
| E-mail address | vida@unist.hr |
| Personal web page | http://more.unist.hr/Organizacija/Imenik/tabid/633/agentType/View/PropertyID/1184/Default.aspx |
| Year of birth | 1980 |
| Scientist ID | 288561 |
| Research or art rank, and date of last rank appointment | Research associate – September 16th, 2011. |
| Research-and-teaching, art-and-teaching or teaching rank, and date of last rank appointment | Assistant professor – December 3rd, 2011. |
| Area and field of election into research or art rank | Biotechnical Sciences, Food Technology |
| INFORMATION ON CURRENT EMPLOYMENT | |
| Institution where employed | University of Split, Department of Marine Studies |
| Date of employment | September 1st, 2006. |
| Name of position (professor, researcher, associate teacher, etc.) | Assistant professor |
| Field of research | Food quality and safety |
| Function | - |
| INFORMATION ON EDUCATION – Highest degree earned | |
| Degree | PhD |
| Institution | Faculty of Food Technology and Biotechnology, University of Zagreb |
| Place | Zagreb |
| Date | December 22nd, 2010. |
| INFORMATION ON ADDITIONAL TRAINING | |
| Year | 2008 |
| Place | Zagreb, Croatia |
| Institution | TAIEX |
| Field of training | Microbiological requirements for food |
| Year | 2009 |
| Place | Lyngby, Denmark |
| Institution | National Institute of Aquatic Resources, Technical University of Denmark |
| Field of training | Biogenic amines in seafood (+HPLC training) |

| | |
|---|---|
| Year | 2009 |
| Place | Copenhagen, Denmark |
| Institution | Seafood Circle i DTUAqua, Technical University of Denmark. |
| Field of training | Seafood and health |
| Year | 2011 |
| Place | Belgrade, Srbia |
| Institution | Faculty of Chemistry, University of Belgrade |
| Field of training | Food Safety and Health Effects of Food |
| Year | 2013 |
| Place | Zagreb, Croatia |
| Institution | TAIEX |
| Field of training | Labelling requirements for fisheries and aquaculture 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) | English (5) |
| Foreign language and command of foreign language on a scale from 2 (sufficient) to 5 (excellent) | Italian (5) |
| Foreign language and command of foreign language on a scale from 2 (sufficient) to 5 (excellent) | Spanish (3) |
| 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) | At undergraduate and graduate levels of the Study "Marine Fisheries", graduate study “Mediterranean Food Technology” and the Inter-university PhD study, "Applied Marine Sciences” at University of Split.<br>Undergraduate Marine fishery<br>- Preservation and processing of seafood (lectures and exercises)<br>- Hygiene in the seafood industry (lectures, exercises, training)<br>- Quality assessment of seafood products (lectures, exercises, training)<br>Graduate Study of Marine Fisheries<br>- Technology chilling and freezing of marine organisms (lectures and exercises)<br>- Preservation of fish salting, drying and smoking (lectures and exercises)<br>-Seafood products (lectures and exercises)<br>Doctoral study<br>-Technology and processing of seafood products |
| 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. T. Bogdanović, I. Ujević, M. Sedak, E. Listeš, **V. Šimat**, S. Petričević, V. Poljak, Vedran. As, Cd, Hg and Pb in four edible shellfish species from breeding and harvesting areas along the eastern Adriatic Coast, Croatia. *Food chemistry*. 146 (2014) 1; 197-203<br>2. I. Mladineo, **V. Šimat**, J. Miletić, R. Beck, V. Poljak, Molecular identification and population dynamic of |

| | |
|---|---|
| | Anisakis pegreffii (Nematoda: Anisakidae Dujardin, 1845) isolated from the European anchovy (Engraulis encrasicolus L.) in the Adriatic Sea. *International journal of food microbiology*. 157 (2012) , 2; 224-229<br>3. T. Bogdanović, **V. Šimat**, A. Frka-Roić, K. Marković, Development and application of Quality Index Method scheme in a shelf life study of wild and fish farm affected bogue (Boops boops, L.). *Journal of food science.* 77 (2012) 811-818.<br>4. **V. Šim**at, T. Bogdanović, M. Krželj, A. Soldo, J. Maršić Lučić, Differences in chemical, physical and sensory properties during shelf life assessment of wild and farmed gilthead sea bream (Sparus aurata, L.). *Journal of Applied Ichthyology*. 28 (2012) 95-101.<br>5. **V. Šimat**, P. Dalgaard, Use of small diameter column particles to enhance HPLC determination of histamine and other biogenic amines in seafood. LWT - Food Science and Technology. 44 (2) (2011) 399-406. |
| Professional and scholarly articles published in the last five years in subjects of teaching methodology and teaching quality (5 works at most) | http://bib.irb.hr/lista-radova?autor=288561 |
| Professional, science and artistic projects in the field of the course carried out in the last five years (5 at most) | 1. Optimization of HPLC method for determination of histamine and other biogenic amine in seafood. 2009.<br>2. Impact of fishing and aquaculture on ecosystem of Adriatic, 2007-2013.<br>3. Hyperspectral detector of parasite *Anisakis* spp. in fish fillets, 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? | |
| PRIZES AND AWARDS, STUDENT EVALUATION | |
| Prizes and awards for teaching and scholarly/artistic work | Award for young scientists, Biotechnical foundation, 2010. |
| 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<br>Average grade for previously mentioned courses in 1012/2013 was >4.8 |

| | |
|---|---|
| First and last name and title of teacher | **PhD, Mladen Šolić** |
| The course he/she teaches in the proposed study programme | Elements of Ecology |
| GENERAL INFORMATION ON COURSE TEACHER | |
| Address | Split, Trondheimska 4C |
| Telephone number | 021 460 933 |
| E-mail address | solic@izor.hr |
| Personal web page | |
| Year of birth | 1959 |
| Scientist ID | 117375 |
| Research or art rank, and date of | Senior research scientist - 11.12.2009. |

| | |
|---|---|
| last rank appointment | |
| Research-and-teaching, art-and-teaching or teaching rank, and date of last rank appointment | Full professor - 30.06.2006. |
| Area and field of election into research or art rank | Natural sciences; biology |
| INFORMATION ON CURRENT EMPLOYMENT | |
| Institution where employed | Institute of Oceanography and Fisheries, Split |
| Date of employment | 1983. |
| Name of position (professor, researcher, associate teacher, etc.) | Senior research scientist |
| Field of research | Marine microbiology and microbial ecology |
| Function | Head of Laboratoriy for Microbiology |
| INFORMATION ON EDUCATION – Highest degree earned | |
| Degree | Senior research scientist |
| Institution | Institute of Oceanography and Fisheries |
| Place | Split |
| Date | 11.12.2009. |
| INFORMATION ON ADDITIONAL TRAINING | |
| Year | 1991 |
| Place | Kiel (Germany) |
| Institution | Institute für Meereskunde |
| Field of training | Marine microbial ecology |
| 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) | *Ecology*, University Center for Marine Studies, University of Split<br><br>*Marine Ecology*, University Center for Marine Studies, University of Split<br><br>*Introduction in Applied Marine Natural Sciences*, Postgraduated PhD Study „Applied Marine Sciences“, University of Split, University of Dubrovnik, Institute of Oceanography and Fisheries, Split<br><br>*Marine Biology*, Interdisciplinary Doctoral Study in Oceanology, University of Zagreb, Ruđer Bošković Institute, Zagreb and Rovinj, Institute Of Oceanography and Fisheries, Split, Institute for Marine and Coastal Research of University in Dubrovnik. |
| Authorship of university/faculty textbooks in the field of the course | **Šolić, M**., N. Krstulović, S. Šestanović, D. Šantić, N. Bojanić, M. Ordulj, S. Jozić. 2016. Microbial Community Ecology of the Adriatic Sea (Šolić, M., N. Krstulović, eds.). LAP Lambert Academic Publishing, Saarbrücken, Germany, 436 p.<br><br>**Šolić, M.** 2015. Kvantitativne metode u ekologiji zajednica. |

| | |
|---|---|
| | Institut za oceanografiju i ribarstvo, Split. 134 str.<br><br>**Šolić, M**. 2014. Ekologija populacija. Institut za oceanografiju i ribarstvo, Split, 347 str.<br><br>**Šolić, M**. 2012. Umijeće življenja. Izvori, Zagreb, 330 str.<br><br>**Šolić, M**. 2009. Ljepota različitosti – ekološki uzroci biološke raznolikosti na Zemlji. Izvori, Zagreb, 288 str.<br><br>Krstulović, N., **M. Šolić**. 2006. Mikrobiologija mora (Sveučilišni udžbenik). Institut za oceanografiju i ribarstvo, Split. 317 str.<br><br>**Šolić, M**., N. Krstulović. 2000. Ekologija morskog bakterioplanktona. Institut za oceanografiju i ribarstvo, Split. 452 str.<br><br>http://fliphtml5.com/homepage/bxnx |
| Professional, scholarly and artistic articles published in the last five years in the field of the course (5 works at most) | **Šolić, M**., N. Krstulović, D. Šantić, S. Šestanović, M. Ordulj, N. Bojanić, G. Kušpilić. 2015. Structure of microbial communities in phosphorus-limited estuaries along the eastern Adriatic coast. *Journal of Marine Biology Association U.K.,* **95**: 1565-1578. doi:10.1017/S0025315415000442.<br><br>Redžić, A., N. Krstulović, **M. Šolić**, D. Šantić, M. Ordulj. 2015. Dynamics of prokaryotic community in Boka Kotorska Bay (South-eastern Adriatic Sea). *Acta Adriatica*, 56: 157-170.<br><br>Ordulj, M., N. Krstulović, D. Šantić, S. Jozić, **M. Šolić**. 2015. Distribution of marine viruses in the Central and South Adriatic Sea. *Mediterranean Marine Science*. 16: 65-72 DOI: http://dx.doi.org/10.12681/mms.911<br><br>Šantić, D., S. Šestanović, M. Šolić, N. Krstulović, G. Kušpilić, M. Ordulj, Ž. Ninčević Gladan. 2014. Dynamics of picoplankton community from coastal waters to the open sea in the Central Adriatic. *Mediterranean Marine Science*. **15**: 179-188. DOI:http://dx.doi.org/10.12681/mms.701.<br><br>Jozić, S., M. Morović, **M. Šolić**, N. Krstulović, M. Ordulj. 2014. Effect of solar radiation, temperature and salinity on the survival of two different strains of *Escherichia coli*. *Fresenius Environmental Bulletin*, **23**: 1852-1859.<br><br>Šantić, D., N. Krstulović, **M. Šolić**, M. Ordulj, G. Kušpilić. 2013. Dynamics of prokaryotic picoplankton community in the central and southern Adriatic Sea (Croatia). *Helgoland Marine Research*, **67**: 471-481.<br><br>Krstulović, N., **M. Šolić**, D. Šantić, J. Maršić-Lučić, M. Ordulj, S. Šestanović. 2013. Microbial community structure in two anchialine caves on Mljet Island (Adriatic Sea). *Acta Adriatica*, **54**: 183-198.<br><br>Bojanić, N., O. Vidjak, **M. Šolić**, N. Krstulović, I. Brautović, S. Matijević, G. Kušpilić, S. Šestanović, Ž. Ninčević Gladan, I. Marasović. 2012. Community structure and seasonal dynamics of tintinnid ciliates in Kaštela Bay (middle Adriatic Sea). *Journal* |

| | |
|---|---|
| | *of plankton research*. **34**: 510-530.<br><br>**Šolić, M**., N. Krstulović, D. Šantić, S. Šestanović. 2012. Kaštela Bay and Stončica (Sites 60-61). *In*: O'Brien, T.D., W.K.W. Li, X.A.G. Moran (Eds), ICES Phytoplankton and Microbial Plankton Status Report 2009/2010. ICES Cooperative Research Report No. 310. 196 pp: 150-152.<br><br>Collos, Y., M. Gasol, **M. Šolić**, D. Soudant, A. Zingone. 2012. Phytoplankton and Microbial Plankton of the Mediterranean Sea. *In*: O'Brien, T.D., W.K.W. Li, X.A.G. Moran (Eds), ICES Phytoplankton and Microbial Plankton Status Report 2009/2010. ICES Cooperative Research Report No. 310. 196 pp: 136-37.<br><br>Jozić, S., **M. Šolić**, N. Krstulović. 2012. The accumulation of the indicator bacteria *Escherichia coli* in mussels (*Mytilus galloprovincialis*) and oysters (*Ostrea edulis*) under experimental conditions. *Acta Adriatica*, **53**: 353-361.<br><br>Šantić, D., N. Krstulović, **M. Šolić**, G. Kušpilić. 2012. HNA and LNA bacteria in relation to the activity of heterotrophic bacteria. *Acta Adriatica*, **53**: 25-40.<br><br>Šantić, D., N. Krstulović, **M. Šolić**, G. Kušpilić. 2011. Distribution of Synechococcus and Prochlorococcus in the central Adriatic Sea. *Acta Adriatica*, **52**: 101-113.<br><br>**Šolić, M**., S. Jozić, N. Krstulović. 2010. Interactive effects of temperature and salinity on the rate of concentration of *Escherichia coli* in mussels (*Mytilus galloprovincialis*) and oysters (*Ostrea edulis*). *Fresenius Environmental Bulletin*, **19**: 1634-1639.<br><br>**Šolić, M**., N. Krstulović, G. Kušpilić, Ž. Ninčević Gladan, N. Bojanić, S. Šestanović, D. Šantić, M. Ordulj. 2010. Changes in microbial food web structure in response to changed environmental trophic status: A case study of the Vranjic Basin (Adriatic Sea). *Marine Environmental Research*, **70**: 239-249.<br><br>https://bib.irb.hr/ |
| 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 the HRZZ Project: "Marine microbial food web processes in global warming perspective"(MICROGLOB) IP-2014-09-4143 (2015-2018).<br>http://jadran.izor.hr/~solic/microglob/<br><br>Leader of the Project of Croatia-Slovenia Cooperation in Science and Technology: „The role of microbial community structure on mercury speciation in the open Adriatic sea" (2014-2015).<br><br>Leader of the Descriptor „Food Webs" in Project: „Skup značajki dobrog stanja okoliša za morske vode pod suverenitetom |

| | |
|---|---|
| | Republike Hrvatske i skup ciljeva u zaštiti morskog okoliša i s njima povezanih pokazatelja, srpanj, 2014.<br><br>Leader of the Subtask „Food web“ in Project: „Policy-oriented marine environmental research in the Southern European Seas“ (PERSEUS). 2012-2016. Funding source: EU-FP7<br><br>Leader of the group for Descriptor 4 in Study: “Dobro stanje okoliša (Good Environmental Status, GES) za morski okoliš pod suverenitetom Republike Hrvatske (www.mzoip.hr) u okviru implemetacije ACAP i MSFD u Hrvatskoj”<br><br>Associate in Project: „Initial assessment of the state and pressures on Croatian part of the Adriatic Sea“ 2011-2012. Financed by: Ministry of Environmental and Nature Protection<br><br>Associate in IPA Project: Ballast Water Management for Adriatic Sea Protection (BALMAS)<br><br>Associate in Research Project of the Ministry of Science of the Republic of Croatia: „The role of plankton communities in the energy and matter flux in the Adriatic Sea “ (001-0013077-0845).<br><br>Leader of the Research Project of the Ministry of Science of the Republic of Croatia: „Residence time of bacteria Escherichia coli in the seawater and marine organisms“ (001-0000000-3177)<br><br>Associate in the Monitoring programme “Monitoring of Coatal Sea Quality, Pag-Konavle”. Author of the chapter „Faecal Pollution Indicators“ (Croatian Waters, from 1986 onwards). |
| 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? | Study of Biology at the Faculty of Natural Science and Mathematics, University of Zagreb (1977-1982)<br><br>Inaugural lecture in fronto f the Commission as a condition for appointment to academic title of Assistant Professor<br><br>15 years experience in teaching at the undergraduate, graduate and postgraduate levels |
| PRIZES AND AWARDS, STUDENT EVALUATION | |
| Prizes and awards for teaching and scholarly/artistic work | The award of the city of Split (group award) as a member of the science team IOF for the achievements in scientific research of the Kaštela Bay (1991)<br><br>Award of the Croatian Academy of Sciences and Arts (HAZU) for the highest achievements in the Republic of Croatia in the field of natural sciences and mathematics (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) | Average grade (form 1 – 5) = **5** |

| | |
|---|---|
| First and last name and title of teacher | **PhD, Marina Trgo, prof.** |
| The course he/she teaches in the proposed study programme | Water technology |
| GENERAL INFORMATION ON COURSE TEACHER | |
| Address | Ruđera Boškovića 35, Split |
| Telephone number | 021329454 |
| E-mail address | mtrgo@ktf-split.hr |
| Personal web page | https://tkojetko.irb.hr/znanstvenikDetalji.php?sifznan=6917 |
| Year of birth | 1972 |
| Scientist ID | 218460 |
| Research or art rank, and date of last rank appointment | Scientific adviser, 9th October 2012 |
| Research-and-teaching, art-and-teaching or teaching rank, and date of last rank appointment | Associate professor, 22nd November 2009 |
| 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 | 1st March 2006 |
| Name of position (professor, researcher, associate teacher, etc.) | Associate professor, higher scientific researcher, |
| Field of research | Lecturer and research work within the field of chemical and environmental engineering |
| Function | |
| INFORMATION ON EDUCATION – Highest degree earned | |
| Degree | PhD |
| Institution | Faculty of Chemistry and Technology, University of Split |
| Place | Split |
| Date | 17th December 2003 |
| 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 |
| 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) | • Industry and environment (2001 - today), lectures, exercises , Faculty of Chemistry and Technology, University of Split<br>• Water in industry (2004 - today), lectures, seminars, exercises , Faculty of Chemistry and Technology, University of Split<br>• Water technology (2006 - today), lectures, seminars, exercises , Faculty of Chemistry and Technology, University of Split<br>• Water technology (2006 - 2010 ), lectures, exercises, University of Applied Sciences, Knin<br>• Chemistry in industry (2007 - today), lectures, Faculty of Science, University of Split |

| | |
|---|---|
| | • Natural zeolites in environmental protection (2010), lectures, Faculty of Chemistry and Technology, University of Split<br>• Wastewater treatment (2004 - 2006), lectures, exercises, Faculty of Chemistry and Technology, University of Split<br>• Industrial wastewaters (2007) lectures, seminars, exercises, 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) | 1. I. Nuić, **M. Trgo**, J. Perić, N. Vukojević Medvidović, Analysis of breakthrough curves of Pb and Zn sorption from binary solutions on natural clinoptilolite, Microporous and Mesoporous Materials, 167 (2013) 55-61.<br>2. M. Kragović, A. Daković, Ž. Sekulić, **M. Trgo**, M. Ugrina, J. Perić, G. D. Gatta, Removal of lead from aqueous solutions by using the natural and Fe(III)-modified zeolite, Applied Surface Science, 258 (2012) 8, 3667-3673.<br>3. N. Vukojević Medvidović, S. Maletić, J. Perić, **M. Trgo**, M. Ugrina, Zinc removal from aqueous solutions by precipitation and coagulation/ flocculation, Proceedings 13th Ružićka Days Today science - tomorrow industry / D. Šubarić (ur.), Osijek, Hrvatsko društvo kemijskih inženjera i tehnologa, 2011, str. 512-519.<br>4. G. Slavić, **M. Trgo**, D. Rušić, J. Perić, N. Vukojević Medvidović, Application of the Yoon-Nelson model and the reactor theory for packed beds on zinc uptake on clinoptilolite, Proceedings of the 3rd Slovenian-Croatian Symposium on Zeolites, T. Antonić Jelić, N. Zabukovec Logar (ur.), Zagreb, Croatian Zeolite Association, 2010, str. 85-88.<br>5. L. Ćurković, **M. Trgo**, A. Rastovčan Mioč, N. Vukojević Medvidović, Removal of Cu and Pb Ions from Aqueous Solutions by Electric Furnace Slag - Kinetic and Thermodynamic Aspects, Indian Journal of Chemical Technology, 16 (2009) 1, 84-88. |
| 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. Technology transfer infrastructure in the Croatian Adriatic region -„TTAdria", IPA2007/HR/16IPO/001-040516, University of Split, 2013 -, scout.<br>2. Development of new Fe(III) modified natural zeolite for environmental application, 2008 - 2010, project leader of bilateral Croatian - Serbian scientific project.<br>3. Natural zeolites in water protection, Ministry of Science, Education and Sport of Republic of Croatia, Zagreb, 2007-2013, researcher (project leader: PhD Jelena Perić, full professor). |
| 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 | Award "Vera Johanides", 2006, for young scientists, Croatian Academy of Engineering. |

| | |
|---|---|
| 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, Ladislav Vrsalović, asociate prof.** |
| The course he/she teaches in the proposed study programme | Electrodeposition processes<br>Solid waste and recycling<br>Surface protection technologies<br>Corrosion and the Environment |
| GENERAL INFORMATION ON COURSE TEACHER | |
| Address | Vukovarska 145, Split |
| Telephone number | 021 / 475 707 |
| E-mail address | ladislav@ktf-split.hr |
| Personal web page | |
| Year of birth | 1974. |
| Scientist ID | 237626 |
| Research or art rank, and date of last rank appointment | Scientific advisor, 26. 11. 2013. |
| Research-and-teaching, art-and-teaching or teaching rank, and date of last rank appointment | Associate professor, 28. 11. 2012. |
| Area and field of election into research or art rank | Technical sciences, Chemical engineering |
| INFORMATION ON CURRENT EMPLOYMENT | |
| Institution where employed | University of Split, Faculty of chemistry and technology |
| Date of employment | 01. 07. 2000. |
| Name of position (professor, researcher, associate teacher, etc.) | Associate professor |
| Field of research | Corrosion, protection of materials |
| Function | |
| INFORMATION ON EDUCATION – Highest degree earned | |
| Degree | Ph.D. |
| Institution | University of Split, Faculty of chemistry and technology |
| Place | Split |
| Date | 03. 04. 2008. |
| INFORMATION ON ADDITIONAL TRAINING | |
| Year | 2007. |
| Place | Rijeka |
| Institution | University of Rijeka |
| Field of training | First Synchrotron Radiation Summer School "Syncro 07". |
| Year | 2004. |
| Place | Zagreb |
| Institution | Center for technology transfer, Faculty of Mechanical Engineering and Naval Architecture, University of Zagreb |
| Field of training | Organization of laboratories according to standard HRN EN ISO/IEC 17025 |
| 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) | Surface protection technology - Graduate study of chemical technology<br>Corrosion and environment – Graduate study of chemical technology<br>Electrodeposition – Undergraduate study of chemical technology<br>Electrodeposition processes – Professional study of chemical technology |
| 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. S. Gudić, **L. Vrsalović**, M. Kliškić, A. Radonić, M. Zekić, I. Jerković, Corrosion inhibition of AA 5052 aluminium alloy in 0.5 M NaCl solution by different types of honey, *International Journal of Electrochemical Science* 11 (2016) 998-1011.<br>2. **L. Vrsalović**, S. Gudić, M. Kliškić, E. E. Oguzie, L. Carev, Inhibition of Copper Corrosion in NaCl Solution by Caffeic Acid, *International Journal of Electrochemical Science*. 11 (2016) 459-474.<br>3. S. Kožuh, **L. Vrsalović**, M. Gojić, S. Gudić, B. Kosec, Comparison of the corrosion behavior and surface morphology of NiTi alloy and stainless steels in sodium chloride solution, *Journal of mining and metallurgy. Section: B, Metallurgy,* 52 (2016) 53-61.<br>4. S. Kožuh, M. Gojić, **L. Vrsalović**, B. Ivković, Corrosion failure and microstructure analysis of AISI 316L stainless steels for ship pipeline before and after welding, *Kovove Materialy - Metallic Materials* 51 (2013) 53-61.<br>5. M. Gojić, **L. Vrsalović**, S. Kožuh, A. Kneissl, I. Anžel, S. Gudić, B. Kosec, M. Kliškić, Electrochemical and microstructural study of Cu-Al-Ni shape memory alloy, *Journal of alloys and compounds* 509 (2011) 9782-9790. |
| 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-09-2014 „Design of microstructure and functional properties of Cu-based shape memory alloys.“ |
| 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, Nediljka Vukojević Medvidović, associate prof.** |
| The course he/she teaches in the proposed study programme | Wastewater engineering<br>Process design |
| GENERAL INFORMATION ON COURSE TEACHER | |
| Address | Ruđer Bošković 35, 21000 Split |
| Telephone number | 021-329-452 |
| E-mail address | nvukojev@ktf-split.hr |
| Personal web page | http://tkojetko.irb.hr/znanstvenikDetalji.php?sifznan=19202 |
| Year of birth | 1976 |
| Scientist ID | 243570 |
| Research or art rank, and date of last rank appointment | Scientific advisor, 26 November, 2013 |
| Research-and-teaching, art-and-teaching or teaching rank, and date of last rank appointment | Associate professor, 26 November, 2012 |
| Area and field of election into research or art rank | Area of Technical Science, field of chemical engineering |
| INFORMATION ON CURRENT EMPLOYMENT | |
| Institution where employed | Faculty of Chemistry and Technology |
| Date of employment | 01 March, 2001 |
| Name of position (professor, researcher, associate teacher, etc.) | Associate professor |
| Field of research | Scientific, educational and professional activities related to wastewater treatment and environmental remediation |
| Function | Head of Department of Environmental Engineering (2013-today) |
| INFORMATION ON EDUCATION – Highest degree earned | |
| Degree | Doctor of Science, (PhD of technical sciences, chemical engineering) |
| Institution | Faculty of Chemistry and Technology |
| Place | Split |
| Date | 25 May, 2007 |
| INFORMATION ON ADDITIONAL TRAINING | |
| Year | 2006 |
| Place | Sofia, Bulgaria |
| Institution | Institute of Organic Chemistry - Bulgarian Academy of Science |
| Field of training | Instrumental Analysis: X-ray, IR and Raman Spectroscopy Application |
| | |
| Year | 2004 |
| Place | Motovun, Croatia |

| | |
|---|---|
| Institution | Faculty of Chemical Engineering and Technology in Zagreb & National Institute for Chemistry in Ljubljana |
| Field of training | International school of ion chromatography |
| | |
| Year | 2000 |
| Place | Tokyo, Japan |
| Institution | National Environmental Training Institute in Tokyo |
| Field of training | Environmental monitoring, Water Quality |
| | |
| Year | 1998 |
| Place | Krakow, Poland |
| Institution | AGH University of Mining and Metallurgy |
| Field of training | Characterization of coal and coke |
| | |
| 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 - excellent) |
| Foreign language and command of foreign language on a scale from 2 (sufficient) to 5 (excellent) | French (3 - good) |
| 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) | • Advanced wastewater treatment (2008-2009), lecture, postgraduate study, Faculty of Chemistry and Technology, University of Split<br>• Process design, (2002- today), seminar, graduate study, Faculty of Chemistry and Technology, University of Split<br>• Wastewater engineering, (2009-today), seminar, laboratory exercise, graduate study, Faculty of Chemistry and Technology, University of Split<br>• Wastewater treatment (2015-today), lecture, seminar, graduate study, Faculty of Chemistry and Technology, University of Split<br>• Water protection (2008–today), lecture, seminar, laboratory exercise, undergraduate study, Faculty of Chemistry and Technology, University of Split<br>• Industrial wastewater, (2008–today), lecture, seminar, laboratory exercise, professional study, Faculty of Chemistry and Technology, University of Split<br>• Water technology (2008), laboratory exercise, graduate study, Faculty of Chemistry and Technology, University of Split<br>• Chemistry and technology of wastewater treatment, (2002-2008), seminar, laboratory exercise, graduate study, Faculty of Chemistry and Technology, University of Split<br>• Water in industry (2004-2007), laboratory exercise, Faculty of Chemistry and Technology, University of Split<br>• Wastewater treatment (2004-2007), laboratory exercise, Faculty of Chemistry and Technology, University of Split |
| Authorship of university/faculty textbooks in the field of the course | J. Perić, **N. Vukojević Medvidović**, I. Nuić, Inženjerstvo otpadnih voda, Priručnik za laboratorijske vježbe, Kemijsko tehnološki fakultet Sveučilišta u Splitu, lipanj 2012. (http://www.ktf-split.hr/bib/nm/inzenjerstvo_otpadnih_voda.pdf). |

| | |
|---|---|
| Professional, scholarly and artistic articles published in the last five years in the field of the course (5 works at most) | 1. I. Nuić, M. Trgo, **N. Vukojević Medvidović**, The application of the packed bed reactor theory to Pb and Zn uptake from the binary solution onto the fixed bed of natural zeolite, Chemical Engineering Journal 295 (2016) 347–357.<br><br>2. **N. Vukojević Medvidović**, J. Perić, Jelena; M. Trgo, I. Nuić, M. Ugrina. Design of the fixed bed column for lead removal on natural zeolite based on batch studies, *Chemical and biochemical engeenering quartely*. 27 (2013) , 1; 21-28.<br><br>3. **N. Vukojević Medvidović,** M. Ugrina, J. Perić, M. Trgo, I. Nuić, I. Ivanković, Dimensional analysis as a useful tool in determining the relationship between sorption phenomena and the solid/liquid ratio// Danas znanost - sutra industrija : zbornik radova / Jukić, Ante (ur.). Zagreb, Osijek : Hrvatsko društvo kemijskih inženjera i tehnologa, Prehrambeno tehnološki fakultet, 2012. 405-414.<br><br>4. M. Trgo, J. Perić, **N. Vukojević Medvidović**, The effect of demulsifier and dewatering agent on separation of phases from oily water, The Holistic Approach to Environment 1 (2011) 1-9.<br><br>5. **N. Vukojević Medvidović**, S. Maletić, J. Perić, M. Trgo, M. Ugrina, Zinc removal from aqueous solutions by precipitation and coagulation/ flocculation, Proceedings 13th Ružićka Days Today science-tomorrow industry / D. Šubarić (ur.). Osijek : Prehrambeno tehnološki fakultet Osijek, Hrvatsko društvo kemijskih inženjera i tehnologa, 2011. 512-519. |
| 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 in bilateral Project with Institute for technology of nuclear and other mineral resources, Beograd, Republic of Serbia: "Low-cost sorbents as a potential materials for *in situ* remediation of heavy-metal contaminated groundwater", 2016-2017.<br>• Collaborator in bilateral project with Geological Department of Slovenia, Ljubljana, Slovenia, Application of natural zeolite for remediation of mercury contaminated soil, 2016-2017 (Project leader: PhD Ivona Nuić).<br>• Collaborator in project HRZZ Research Projects (IP-11-2013-4981) Natural zeolites as a reactive barrier for landfill leachate treatment-NAZELLT, 2014-2018 (Project leader: PhD Marina Trgo, full professor)<br>• Collaborator in project "Natural zeolite in water protection", Ministry of Science, Education and Sports of the Republic of Croatia, Croatia, 2007-2013 (Project leader: PhD Jelena Perić, professor emeritus) |
| 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 | • Award of Faculty for academic year 1994/95<br>• Award of Faculty for academic year 1996/97<br>• Award of Faculty for academic year 1997/98<br>• Recognition for promotion of the Faculty of Chemistry and Technology in Split for academic year 2011/2012 |
| 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) | - University of Split, EvaSys Evaluation, Average grade 4.4.-5.0 on in grading scale 1.0-5.0. Course evaluated: Wastewater engineering, Wastwater treatment, Industrial wastewater, Process design, Water protection |

| | |
|---|---|
| First and last name and title of teacher | **PhD, Jelica Zelić, prof.** |
| The course he/she teaches in the proposed study programme | Inorganic processes in the heterogeneous systems<br>Corrosion and degradation of building materials<br>Structure and properties of inorganic non-metallic materials<br>Glass and ceramics |
| GENERAL INFORMATION ON COURSE TEACHER | |
| Address | Ruđera Boškovića 35, 21000 Split |
| Telephone number | 00385 21 329 442 |
| E-mail address | zelic@ktf-split.hr |
| Personal web page | - |
| Year of birth | 1952 |
| Scientist ID | 143203 |
| Research or art rank, and date of last rank appointment | Research adviser (June 10, 2008) |
| Research-and-teaching, art-and-teaching or teaching rank, and date of last rank appointment | full professor in permanent position (June 28, 2013) |
| 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 | September 15, 1993 |
| Name of position (professor, researcher, associate teacher, etc.) | full professor in permanent position |
| Field of research | Cement composite materials with improved properties |
| Function | the head of the Dept. of Inorganic technology |
| INFORMATION ON EDUCATION – Highest degree earned | |
| Degree | Ph. D. in Technical sciences (chemical engineering) |
| Institution | Faculty of Technology, University of Split |
| Place | Split |
| Date | May 26, 1997 |
| INFORMATION ON ADDITIONAL TRAINING | |
| Year | 1978-1993 (15 years) |
| Place | Dugi Rat, Croatia |
| Institution | The Dalmacia Ferroalloys Works, Dugi rat, Croatia |
| Field of training | Work experience: Research, development and introducing advanced technology as replacement for existing one, raw materials-production process relationship and processes |

| | |
|---|---|
| | optimisation. |
| 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) | • Inorganic materials (Undergraduate study of Chemistry and Chemical Technology)<br>• Selected processes of chemical industry (Undergraduate study of Chemistry and Chemical Technology) |
| Authorship of university/faculty textbooks in the field of the course | • Z. Osmanović, **J. Zelić**, Portland cement production/ Proizvodnja Portland-cementa, Manualia Universitatis Studiorum Tuzlaensis, University of Tuzla, B&H, Tuzla, 2010., ISBN 978-9958-897-04-7. http://www.knjiga.ba/proizvodnja_portlandj_cementa-k7412.html<br>• J. Zelić, Z. Osmanović, Strength and Durability of Cement Composites/ Čvrstoća i trajnost cementnih kompozita, (in Croatian), Manualia Universitatis Studiorum Spalatensis, University of Split, Split, 2014, ISBN 978-953-7803-01-8. https://www.ktf.unist.hr/index.php/nastavni-materijali-knjiznice/repozitorij-265?start=40<br>• **J. Zelić**, Practicum in the processes of inorganic industry/Praktikum iz procesa anorganske industrije, Faculty of Chemistry and Technology, Split, 2013 (reviewed and edited teaching materials),http://www.ktf-split.hr/bib/nm/Procesi_anorganske_industrije.pdf<br>• **J. Zelić**, Engineering of Selected Inorganic Materials, Faculty of Chemistry and Technology in Split, Split, 2013 (reviewed and edited teaching materials on english language), http://www1.ktf-split.hr/bib/nm/Inzenjerstvo_odabranih_anorganskih_materijala_en.pdf<br>• T. Terić, **J. Zelić**, Structural phase analysis/ Strukturna analiza faza, Faculty of Chemistry and Technology in Split, Split, 2008. (printed course materials). |
| Professional, scholarly and artistic articles published in the last five years in the field of the course (5 works at most) | 1. M. N. Mužek; S. Svilović; M. Ugrina; J. Zelić: Removal of copper and cobalt ions by fly ash-based geopolymer from solutions-equilibrium study, *Desalination and Water Treatment*. **57** (2016), pp. 10689-10699.<br>2. J. Zelić: Industrial waste materials in cement |

| | |
|---|---|
| | composites imncreased strength and durability. *Book of Abstracts with electronic eddition of Proceedings, 10th Scientific-Research Symposium with International Participation, METALLIC AND NONMETALLIC MATERIALS: production-properties-application, MNM 2014,* S. Muhamedagić (ed.), Bugojno (B&H): University of Zenica (B&H), Faculty of Metallurgy and Material Science, 2014, pp. 13-33. (Key note paper)<br><br>3. M. N. Mužek; S. Svilović; J. Zelić: Fly ash-based geopolymeric adsorbent for copper from wastewater, *Desalination and Water Treatment*. **52** (2014),13/15; pp. 2519-2526.<br><br>4. M. N. Mužek; M. Jelović; S. Svilović; J. Zelić: Equilibrium studies of cobalt ions removal using fly ash Class F. *Proceedings Eurasia Waste Management Symposium 2014*, M. Sinan Bilgili (ed.), Istanbul, Turkey : Yildiz Technical University, 2014, pp. 666-672.<br><br>5. M. N. Mužek; J. Zelić; D. Jozić: Microstructure characteristics of geopolymers based on alkali-activated fly ash. *Chemical and Biochemical Engineering Quartely*. **26** (2012), 2; pp. 89-95. |
| 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 011-1252970-2252: Utilization of fly ash in new inorganic binding materials, *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) | |

## 3.4. Optimal number of students

The optimal number of students in the graduate study of Chemical Technology in terms of space, equipment and number of full-time teachers is 60 and represents the proposed admission quota.

## 3.5. Estimate of costs per student

Average annual tuition fee per student amount about 31,500.00 kunas.

## 3.6. Plan of procedures of study programme quality assurance

<table>
<tr><td colspan="2">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.</td></tr>
<tr><td colspan="2">Documentation on which the quality assurance system of the constituent part of the University is based:</td></tr>
<tr><td colspan="2">• Regulations on the quality assurance system of the constituent part (enclose if existing)</td></tr>
<tr><td colspan="2">• Handbook on the quality assurance system of the constituent part (enclose if it exists)</td></tr>
<tr><td colspan="2">Description of procedures for evaluation of the quality of study programme implementation:<br>• 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<br>• If procedure is described in an attached document, name the document and the article.</td></tr>
<tr><td>Evaluation of the work of teachers and part-time teachers</td><td>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.</td></tr>
<tr><td>Monitoring of grading and harmonization of grading with anticipated learning outcomes</td><td>Procedures, rules and criteria for grading of students 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,</td></tr>
</table>

| | |
|---|---|
| | 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 education (where this applies) | Evaluation of student training is conducted orally by the 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** | Results are available on the official web site of the Faculty |

| | |
|---|---|
| **informing external parties on the study programme (students, employers, alums)** | (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. |