STUDY PROGRAMME ENVIRONMENTAL PROTECTION

BACHELOR ACADEMIC STUDIES

Study programme name:	**Environmental Protection**
Higher education institution in which the study programme is implemented:	**University of Niš, Faculty of Occupational Safety in Niš**
Educational / educational-scientific field:	**Technical and technological sciences**
Scientific, professional, or artistic discipline:	**Environmental and Occupational Safety Engineering**
Type of studies:	**Bachelor academic studies**
Scope of studies in ECTS credits:	**240 ECTS credits**
Degree title:	**Bachelor with Honours in Occupational Safety Engineering**
Duration of studies:	**4 years**
Maximum number of students to enrol in the study programme:	**120**
Language in which the study programme is implemented:	**Serbian**

STUDY PROGRAMME OBJECTIVES

Objectives of the bachelor academic studies study programme **Environmental Protection** stem from the primary commitments and strategic documents of the Faculty of Occupational Safety in Niš as a scientific-educational institution, as well as from the study programme purpose.

The **aim** of the study programme is to enable students to apply scientific and professional achievements in the field of environmental engineering. In addition to helping them acquire competences, knowledge, and skills regarding environmental protection, the aim is also to develop their creative engineering capabilities when dealing with environmental issues, their capability of analytical and critical thinking, and their ability to work in a team.

Programme **objectives** include the acquisition of general and specific theoretical knowledge and practical skills for

- Environmental hazard and risk identification;
- Development and application of sustainable environmental solutions;
- Development and application of sustainable development and environmental strategies and policies;
- Establishment and implementation of the principle of integrated prevention and control of environmental pollution;
- Environmental pollution and degradation monitoring;
- Environmental quality monitoring;
- Supervision of environmental protection;
- Employee education and training for environmental protection; and
- Organization and management of the environmental protection system in organizations and local communities.

The defined aims and objectives suggest two basic intentions of the study programme – first, training for direct transition from studying to performing environmental protection jobs, and second, proceeding to the master academic studies at the Faculty of Occupational Safety in Niš or other higher education institutions in the same or similar fields of study.

STUDY PROGRAMME OUTCOMES – STUDENTS' COMPETENCES UPON PROGRAMME COMPLETION

Overview of general and course-specific student competences:

Completion of the bachelor academic studies study programme Environmental Protection provides students with the following general competences:

- Analysis of environmental issues;
- Prediction and implementation of solutions in environmental protection;
- Firm grasp of methods, procedures, and processes of risk identification;
- Development of critical thinking and integral approach to environmental issues;
- Practical application of knowledge;
- Development of communication skills in the immediate and broader surrounding;
- Development of professional ethics.

Overview of the learning outcomes:

Upon completion of the study programme, students also acquire course specific skills and become professionally competent to:

- apply methods and procedures of environmental risk pre-analysis;
- organize and conduct environmental risk assessment activities;
- measure and control the state of the environment;
- maintain environmental quality;
- record, analyze, and interpret data on injuries, diseases, property damage, and environmental impact;
- apply methods and procedures for energy efficiency assessment;
- devise local environmental protection and sustainable development strategies;
- implement environmental impact assessment and devise studies on impact assessment and strategic impact assessment;
- devise studies on hazardous material impact assessment;
- devise plans and programs for hazardous material accident prevention;
- implement integrated pollution prevention and control and prepare documentation for integrated licence;
- design environmental protection systems and devise and implement plans and programs for environmental protection monitoring;
- create and update a registry of environmental states and pollutants;
- implement waste and hazardous material management;
- establish an integrated management system;
- supervise environmental protection;
- educate and manage knowledge in environmental protection;
- manage projects and innovations in the environmental protection system;
- use information and communication technology in environmental engineering.

Bachelor engineers of environmental protection are able to pursue master studies in the same or related fields of study.

STUDY PROGRAMME PURPOSE

The purpose of the bachelor academic studies study programme **Environmental Protection** is to educate students to become bachelor engineers of environmental protection in times of ever-increasing environmental degradation and in keeping with the needs of economic and social development within the accepted development strategy and the achievement of sustainable development.

The Faculty of Occupational Safety in Niš defined the education of highly competent personnel in the field of environmental protection as one of its fundamental tasks and goals in keeping with the vision, mission, policy, and strategy of quality. The content of the study programme Environmental Protection fully corresponds to the fundamental tasks and goals of the faculty and provides a leading position in the field of environmental protection and improvement. The study programme is designed to fully support the aforementioned goals and to enable students to acquire competences, knowledge, and skills for understanding environmental processes and issues.

The study programme content helps students acquire knowledge in the fields of natural sciences, technical and technological sciences, social sciences and humanities, and medical sciences, and acquire skills and competences that will allow them to work on complex and multidisciplinary environmental protection tasks. Accordingly, the programme is designed to provide sufficient knowledge from basic scientific disciplines (mathematics, physics, chemistry, mechanics, etc.), general engineering disciplines (mechanical engineering, energy engineering, etc.), specific environmental engineering disciplines, as well as specific social and medical disciplines needed to identify, understand, and overcome the negative anthropogenic environmental impact. The programme teaches students to: perform systems analysis of environmental problems; understand environmental processes and problems; record, analyze, and present data on the state of the environment; understand the requirements of the environmental management system; and understand the socio-economic principles of environmental protection and educational needs of environmental protection.

In times of increasing anthropogenic environmental impact, a study programme designed in this way educates future professionals who will be able to identify global effects and cumulative risks of environmental pollution and suggest possible solutions, and who possess the knowledge, competence, and skills that meet European and global criteria, which makes this programme socially justifiable and beneficial.

ADMISSION REQUIREMENTS

The Faculty of Occupational Safety in Niš enrols 120 students in the first year of the bachelor academic studies study programme **Environmental Protection**. The number of students is determined in accordance with society's needs for educated professionals in human, material, and natural resource safety, as well as in accordance with the faculty resources and candidates' interests.

The admission procedure is regulated by the Law on Higher Education, the Statute of the University of Niš, Regulations on Bachelor Academic Studies at the Faculty of Occupational Safety, and the Competition for Selective Admission to the first year of bachelor academic studies at state-founded faculties. The Competition designates the following: the number of students (total and by source of financing); competition deadlines; competition procedure; admission requirements; ranking criteria for candidates; guidelines and deadlines for complaints about the preliminary ranking; and the tuition fee for self-financing students.

All persons who have completed four years of secondary education are eligible to apply for a bachelor academic studies study programme.

Candidates applying for admission into the first year of studies must take the entrance exam in two fields, which they select from a group of five fields: mathematics, physics, chemistry, information science, and ecology and environmental protection. The entrance exam tests for these fields are designed according to their corresponding vocational secondary school syllabi.

Candidates who won one of the first three places during their third or fourth year of secondary education either in a national student competition organized by the Ministry of Education, Science, and Technological Development or in an international competition in one of the five aforementioned fields are not required to take the entrance exam in that field. Such candidates are automatically awarded the maximum number of points for the entrance exam.

Candidates are ranked based on the grade averages from their secondary education and the number of points obtained through the entrance exam. A candidate can receive a maximum of 100 points, comprising a maximum of 40 points based on secondary school grades and a maximum of 60 points on the entrance exam. The entrance exam passing (and inclusion in the rankings) minimum is 14 points. The Faculty of Occupational Safety in Niš performs the preliminary ranking of all candidates according to their total number of points.

Candidates may file a complaint regarding any violation of the procedure established in the Competition rules, regarding any irregularity during the entrance exam, or regarding their ranking within 36 hours after the faculty has published the preliminary rankings. When a complaint has been filed, the faculty Dean has to settle the complaint within 24 hours. After every complaint has

been handled, the Faculty of Occupational Safety in Niš determines and publishes the final rankings. Successful candidates may proceed with their enrolment only after the final rankings have been published.

Candidates may enrol as state-financed (or "budget") students if they rank within the approved number of students for state-paid tuition fees and if they receive a minimum of 50 points.

Candidates may enrol as self-financed students if they rank within the approved number of students for self-paid tuition fees and if they receive a minimum of 30 points.

The faculty timely notifies future students about the entrance exam program, preparatory lessons, and teacher consultations via a printed information brochure, the faculty website, and the faculty Facebook page.

Regulations on Bachelor Academic Studies at the Faculty of Occupational Safety in Niš also comprehensively regulate requirements and procedures for enrolment in a bachelor academic studies study programme for students already attending other faculties or higher education institutions, for persons with previously completed higher education, as well as for persons whose student status has expired.

STUDENT GRADING AND PROGRESS

Students' knowledge is continually tested and evaluated throughout the semester, while the final grade is given at the exam in accordance with the law and general acts. The evaluation is performed by awarding points for any type of activity and testing during the semester (pre-exam requirements) and at the exam itself, where the final grade is given according to the number of points awarded.

The pre-exam requirements are evaluated according to the following criteria:

- active participation during lectures and exercises – up to 10 points;
- project assignment –20 to 30 points;
- term papers and technical drawing assignments – 10 to 20 points;
- homework assignments (arithmetic problems, topic presentations, essays, etc.) – up to 5 points;
- preliminary exams (colloquia) – 15 to 30 points;
- laboratory practice and report completion – up to 10 points;
- participation in seminars – up to 10 points.

The study programme defines the following point distribution: a maximum of 60 points for activities and tests during the semester (pre-exam requirements) and a maximum of 40 points for the final exam. When the students have fulfilled all

their pre-exam requirements, the teachers are obligated to enter the evaluation results (points) and the dates of completion into the student index no later than the day of the final exam. When all classes in a semester have ended, the structure and the total number of points awarded to students as part of their pre-exam requirements are published on the students' noticeboard and the faculty website.

By meeting the pre-exam requirements and completing their exams, students can receive a maximum of 100 points. For each specific course, students who have met all the pre-exam requirements specified in the syllabus and thereby received a minimum of 30 points are eligible to take the exam.

Students may take the exam after all classes for the course have ended, during the terms determined by the law and the Regulations on Bachelor Academic Studies at the Faculty of Occupational Safety in Niš. Exams may be only written, only oral, or both written and oral. Students' exam achievements are graded from 5 (failed) to 10 (exceptional). The final exam grade is based on the total number of points the students received after meeting their pre-exam requirements and taking the exam, according to the following grading:

- from 91 to 100 points – grade 10 = exceptional;
- from 81 to 90 points – grade 9 = excellent;
- from 71 to 80 points – grade 8 = very good;
- from 61 to 70 points – grade 7 = good;
- from 51 to 60 points – grade 6 = sufficient;
- up to 50 points – grade 5 = failed.

The final exam grade and the total number of points received from the pre-exam requirements and the exam itself are entered into exam records, into the student index, and the individual student's exam application, and then validated by the professor's signature. Grade 5 (failed) is not entered into the student index. The faculty is obligated to keep permanent records of all completed exams.

SELECTION OF COURSES FROM OTHER STUDY PROGRAMMES

If they so choose, students may attend and take the exam for a course taught at another study programme at the faculty or another higher education that is unrelated to any of the courses in their selected study programme at the faculty. The number of ECTS credits thus received will not be included in the total number of points received at the students' selected study programme, which is used in the student ranking for state-budget coverage of the tuition fee. In addition, the grade received at the exam for such an unrelated course will

also not be included in the grade average during the studies. Mutual rights and obligations of the higher education institutions involved, including the method of financing and the students' rights and obligations, are regulated by an inter-institutional agreement. The diploma supplement issued to students includes the number of ECTS credits received for completing the unrelated course.

Students of the faculty may complete a portion of their study programme through a compatible study programme at another higher education institution provided an agreement on ECTS credit recognition has been signed between the faculty, or the university, and the other higher education institution (the so-called student mobility). The portion of the study programme students complete at another higher education institution may include one or more courses.

An exam completed at another higher education institution may be recognized provided that the course belongs to a compatible study programme of the same level and type of studies and has a syllabus that is compatible with the corresponding course at the Faculty of Occupational Safety in Niš. To have their exam recognized, students are required to submit an exam recognition request, a certificate of exam completion, compatible study programme details, and the proof of payment of exam recognition fees. The decision on the exam recognition is made by the Teaching Committee with consent from the teacher of the given course.

REQUIREMENTS FOR SWITCHING STUDY PROGRAMMES

Students of the Faculty of Occupational Safety in Niš are allowed to switch study programmes within the bachelor academic studies at the faculty. The transfer requires a written request from the student submitted no later than the enrolment term deadline, which is then decided upon by the Dean based on the opinion given by the Teaching Committee. The study programme transfer approval includes recognized exams and other fulfilled requirements accompanied by the ECTS credits students need to receive and the requirements they need to fulfil during the remainder of their studies.

Students from another higher education institution may request to transfer to a study programme at the Faculty of Occupational Safety in Niš no later than the enrolment term deadline. Such students may be enrolled only as self-financed students provided there are vacant positions at the chosen study programme. The transfer/enrolment request submission also has to include a request for the recognition of previously completed exams, details about the previous study programme, a certificate of exam completion, and the proof of payment of ECTS recognition fees. The Teaching Committee, with previous consent from the

teachers of courses to be recognized, makes a decision regarding the recognition of completed exams and ECTS credits. The same decision determines the students' requirements for the remainder of their studies.

ECTS credits may be transferred within the same level and type of studies. Exceptionally, students participating in international student mobilities may transfer ECTS credits between different study programmes within any level or type of studies. ECTS credit transfer criteria are prescribed by a general university act and the agreement between the university and another higher education institution.

STUDY PROGRAMME STRUCTURE

The bachelor academic studies (BAS) study programme Environmental Protection (EP) comprises the following elements stipulated by the Law on Higher Education: study programme name and objectives; type of studies and results of the learning process; academic degree; study programme admission requirements; list of required and elective courses with course outlines; procedure and duration of studies; credit value (ECTS) of courses and the diploma thesis; course pre-requirements; procedure for selecting courses from other study programmes; and requirements for switching study programmes within the same or related fields of study.

The study programme structure complies with the Accreditation Standards for the First and Second Level of Higher Education.

The study programme lasts 4 years (8 semesters) and comprises 240 ECTS credits.

The study programme is implemented through:

- Required courses, which include the fundamental knowledge students need to acquire;
- Elective courses, which help students shape their educational profile in more detail;
- Internship, which students do in the seventh semester; and
- Diploma thesis, which students complete in the eighth semester.

The study programme comprises 32 required courses including the Internship, 16 elective courses (8 of which are chosen), and the diploma thesis. Students opt for 8 elective courses from 8 groups of two courses distributed as follows: second year – one elective group with two courses of which one is chosen; third year – three elective groups with two courses, whereby one course from each group is chosen; and fourth year – four elective groups with two courses, whereby one course from each group is chosen. Each course comprises a specified number of ECTS credits. The electivity factor of the study programme is 20.00 %.

Within the study programme structure, the percentage of different course types is as follows:

- Academic-general 15.00 %;
- Theoretical-methodological 21.04 %;
- Scientific-professional 37.92 %;
- Professional-applicative 26.04 %.

Total student activities comprise active classes (lectures, exercises, laboratory work, term papers, and other forms of active classes), individual work, preliminary exams (colloquia), examinations, writing of the diploma thesis, and other activities. The average number of active classes per week is 21.46-21.51 (21.49 weekly average). The total number of lecture classes within the study programme is 86 (10.75 weekly average), the total number of exercise classes is 77 (9.62 weekly average), other forms of active classes 4.88 (0.61 weekly average), research study 4 (0.50 weekly average), and other classes 8 (1.00 weekly average). The remaining time of the 40-hour work week is dedicated to other individual student activities.

Internship is an integral part of the study programme. It is done in pertinent scientific research institutions, organizations dedicated to innovation activities, organizations providing infrastructural support to innovation activities, companies, and public institutions, all for the purpose of enabling students to practically apply their acquired knowledge to solving current problems of environmental protection. It comprises 3 ECTS credits.

The study programme is completed upon completion and public defence of the diploma thesis. Through their diploma thesis, students demonstrate their ability to synthesize and apply the acquired theoretical and practical knowledge to solving occupational safety problems in organizations as well as in their local community. The diploma thesis comprises 8 ECTS credits in total, of which the research study comprises 5 and the writing and defence of the thesis 3 ECTS credits.

Upon completion of the studies, students receive the academic degree

Bachelor with Honours in Environmental Engineering

COURSE DISTRIBUTION BY SEMESTER AND YEAR OF STUDY

#	Code	Course name	Term paper	Active classes				Oth.	ECTS	Required/ Elective (R/E)	Course type
				Le.	Ex.	Oth.	RS				
FIRST YEAR											
1.	19.OZNR01	Mathematics	1	3	3	0	0	0	6	R	AG
2.	19.OZNR02	Chemistry	1	3	2	0.67	0	0	6	R	AG
3.	19.OZNR03	Safety System Fundamentals	1	2	2	0	0	0	6	R	TM
4.	19.OZNR04	Sociology	1	2	2	0	0	0	6	R	AG
5.	19.OZNR05	Legal Fundamentals of Safety	1	2	2	0	0	0	6	R	SP
6.	19.OZNR06	Physics	2	3	2	0.67	0	0	6	R	AG
7.	19.OZNR07	Computer Science Fundamentals	2	2	1	0.53	0	0	6	R	AG
8.	19.OZNR08	Engineering Graphics	2	3	1	0.53	0	0	6	R	TM
9.	19.OZNR09	English Language	2	2	2	0	0	0	6	R	AG
10.	19.OZNR10	Safety Economics	2	2	2	0	0	0	6	R	TM
Total classes (lectures/exercises + other) and credits per year				24	19	2.40	0	0	60		
Total active classes per year				45.40				0	60		
SECOND YEAR											
11.	19.OZNR11	Electrotechnics Fundamentals	3	3	2	0	0	0	6	R	TM
12.	19.OZNR12	Mechanical Engineering Fundamentals	3	3	2	0	0	0	6	R	TM
13.	19.OZNR13	Technological Systems and Safety	3	2	2	0	0	0	6	R	SP
14.	19.OZNR14	Risk from Hazardous Materials	3	2	2	0	0	0	6	R	SP
15.	19.OZNR15	Systems and Risk Modelling	3	2	2	0.13	0	0	6	R	SP
16.	19.OZNR16	Chemical Parameters of Occupational and Environmental Quality	4	2	2	0.27	0	0	6	R	SP
17.	19.OZNR17	Thermodynamics and Thermotechnics	4	2	2	0	0	0	6	R	TM
18.	19.OZNR18	Technical Materials	4	2	2	0	0	0	6	R	TM
19.	19.OZNR19	Safety Statistics	4	2	2	0.27	0	0	6	R	TM
20.	19.OZNR20	Occupational and Environmental Quality Indicators	4	2	2	0	0	0	6	E	SP
	19.OZNR21	Fire and Explosions	4	2	2	0	0	0	6	E	SP
Total classes (lectures/exercises + other) and credits per year				22	20	0.67	0	0	60		
Total active classes per year				42.67				0	60		
THIRD YEAR											
21.	19.OZNR23	Electromagnetic Radiation	5	2	2	0	0	0	6	R	SP
22.	19.OZZS01	Energy and the Environment	5	2	2	0	0	0	6	R	SP
23.	19.OZZS02	Waste Management	5	2	2	0	0	0	6	R	SP
24.	19.OZOP04	Emergencies	5	2	2	0	0	0	6	E	SP
	19.OZZS03	Energy Efficiency in Building Design and Construction	5	2	2	0	0	0	6	E	PA
25.	19.OZZS04	Environmental Chemistry	5	2	2	0	0	0	6	E	SP
	19.OZNR24	Toxicology	5	2	2	0	0	0	6	E	SP

26.	19.OZZS05	Air Protection	6	2	2	0.53	0	0	6	R	PA
27.	19.OZZS06	Water Protection	6	2	2	0.53	0	0	6	R	PA
28.	19.OZZS07	Soil Protection	6	2	2	0	0	0	6	R	PA
29.	19.OZNR31	Theory and Organization of Safety Education	6	2	2	0	0	0	6	R	SP
30.	19.OZZS08	Instrumental Methods of Pollutant Analysis	6	2	2	0.20	0	0	6	E	PA
	19.OZZS09	Public Utility Systems and the Environment	6	2	2	0	0	0	6	E	PA
Total classes (lectures/exercises + other) and credits per year				20	20	1.06 - 1.26	0	0	60		
Total active classes per year				41.06-41.26				0	60		
FOURTH YEAR											
31.	19.OZNR36	Risk Assessment Methods	7	2	2	0	0	0	6	R	PA
32.	19.OZZS10	Industrial Ecology	7	2	2	0	0	0	5	R	PA
33.	19.OZZS11	Spatial Planning and Environmental Protection	7	2	2	0	0	0	6	R	PA
34.	19.OZNR37	Safety Application of Information Technology	7	2	2	0.27	0	0	5	E	SP
	19.OZNR38	Integrated Management Systems	7	2	2	0	0	0	5	E	SP
35.	19.OZZS12	Environmental Impact Assessment	7	2	2	0	0	0	5	E	PA
	19.OZZS13	Sustainable Development	7	2	2	0	0	0	5	E	SP
36.	19.OZZS14	Internship	7	0	0	0	0	6	3	R	PA
37.	19.OZZS15	Ecological Risk	8	3	2	0	0	0	6	R	SP
38.	19.OZZS16	Environmental Noise	8	3	2	0.53	0	0	6	R	SP
39.	19.OZZS17	Integrated Pollution Prevention and Control	8	2	2	0	0	0	5	E	PA
	19.OZNR44	Industrial Waste Treatment	8	2	2	0	0	0	5	E	PA
40.	19.OZZS18	Natural Resource Management	8	2	2	0	0	0	5	E	SP
	19.OZNR46	Health Protection	8	2	2	0	0	0	5	E	TM
41.	19.ZZS19A	Diploma Thesis – Research	8	0	0	0	4	0	5	R	PA
42.	19.ZZS19B	Diploma Thesis – Writing and Defence	8	0	0	0	0	2	3	R	PA
Total classes (lectures/exercises + other) and credits per year				20	18	0.53 - 0.80	4	8	60		
Total active classes per year				42.53-42.80				8	60		
Total active classes, other classes, and credits for all years				171.66-172.13				8	240		

Abbreviations:

- Le. – Lectures
- Ex. – Exercises
- Oth. – Other forms of classes
- RS – Research study
- AG – Academic-general
- TM – Theoretical-methodological
- SP – Scientific-professional
- PA – Professional-applicative

LIST OF REQUIRED COURSES

1. Mathematics
2. Chemistry
3. Safety System Fundamentals
4. Sociology
5. Legal Fundamentals of Safety
6. Physics
7. Computer Science Fundamentals
8. Engineering Graphics
9. English Language
10. Safety Economics
11. Electrotechnics Fundamentals
12. Mechanical Engineering Fundamentals
13. Technological Systems and Safety
14. Risk from Hazardous Materials
15. Systems and Risk Modelling
16. Chemical Parameters of Occupational and Environmental Quality
17. Thermodynamics and Thermotechnics
18. Technical Materials
19. Safety Statistics
20. Electromagnetic Radiation
21. Energy and the Environment
22. Waste Management
23. Air Protection
24. Water Protection
25. Soil Protection
26. Theory and Organization of Safety Education
27. Risk Assessment Methods
28. Industrial Ecology
29. Spatial Planning and Environmental Protection
30. Internship
31. Ecological Risk
32. Environmental Noise
33. Diploma Thesis – Research
34. Diploma Thesis – Writing and Defence

Course name: Mathematics

Course status: Required	**Course code:**	19.OZNR01

ECTS credits: 6

Requirements: -

Course aim

Acquisition of knowledge from linear algebra, analytic geometry, and mathematical analysis, which is necessary for the study of phenomena and processes in the field of occupational and environmental engineering.

Course outcome

Students' acquisition of skills and ability to apply:

- linear algebra to the modelling of phenomena with multiple unknown quantities;
- analytic geometry to the analysis of problems in a plane or in space;
- differential and integral calculus to the examination of dynamic systems.

Course outline

Theoretical lessons

Matrices and determinants: Characteristics of matrices and determinants. Operations with matrices. Laplace expansion and Rule of Sarrus. Invertible matrix. **Systems of linear equations:** Number of system solutions, homogeneous and nonhomogeneous systems. Gauss' method. Cramer's rule. Matrix method for solving a system of equations. **Complex numbers:** Operations with complex numbers. Trigonometric form of a complex number. De Moivre's formula and roots of a complex number. **Vectors and analytic geometry:** Definition of vector. Basic vector operations. Vectors in the rectangular coordinate system. Scalar, vector, and mixed product of vectors. Plane, line, and their interrelations. **Differential calculus:** Limits of real sequences. Real functions of a single variable and their limits. Derivative of a function and differentiation rules. Application of derivatives – tangent of a curve, velocity, acceleration, minimum/maximum problems. Examination of functions using differential calculus. **Integral calculus:** Indefinite integral. Integration by substitution and partial integration for indefinite integrals. Integration of rational functions. Definite integral and its application. **Ordinary differential equations:** Examples of simple differential equations. Linear differential equation of first and second order. Modelling of phenomena and processes using differential equations.

Practical lessons

Practical lessons completely follow the theoretical lessons and include mathematical problems. Students are introduced to *Mathematica* software package.

Literature

[1] Aleksić Violeta, Vidanović Mirjana, Stanković Miomir (2006). *Matematika, 1. deo, elementi teorije i zadaci sa rešenjima*. Niš: Univerzitet u Nišu, Fakultet zaštite na radu u Nišu

[2] Aleksić Violeta, Vidanović Mirjana, Stanković Miomir (2006). *Matematika, 2. deo, elementi teorije i zadaci sa rešenjima*. Niš: Univerzitet u Nišu, Fakultet zaštite na radu u Nišu

[3] Kečkić Jovan, Stanković Miomir (1981). *Matematika 1*. Niš: Univerzitet u Nišu

[4] Pejović Tadija (1981). *Matematička analiza I.* Beograd: Naučna knjiga

[5] Miličić Pavle, Momčilo Uščumlić (1996). *Zbirka zadataka iz više matematike I*. Beograd: Nauka

Number of active classes (weekly)

Lectures	3	Auditory exercises	3	Other forms of classes	-	RS	-	Other classes	-

Teaching methods

Lectures, auditory (calculation) exercises, office hours. Interactive work with students.

Grading (maximum number of points: 100)			
Pre-exam requirements	Points	**Exam**	Points
Activity during lectures	5	Written exam (practical part of the exam)	20
Activity during exercises	5	Oral exam (theoretical part of the exam)	20
Colloquium 1	25		
Colloquium 2	25		

Course name: Chemistry		
Course status: Required	**Course code:**	19.OZNR02
ECTS credits: 6		
Requirements: -		

Course aim

Acquisition of knowledge pertaining to chemical terms, laws, and principles necessary to understand occupational and environmental states and processes.

Course outcome

Students' acquisition of skills and ability to:

- understand the structure of chemical substances and the chemical interactions influenced by it;
- understand the physicochemical factors in the processes of matter creation;
- analyze states of matter and define its behaviour in an environment;
- understand the characteristics of the main classes of organic compounds depending on the present functional group;
- apply chemical knowledge in chemical disciplines in the fields of occupational, environmental, and fire safety.

Course outline

Theoretical lessons

Basic terms and laws in chemistry: Matter. Chemical elements and compounds. Mixtures of substances. Law of conservation of mass. Law of constant proportions. Law of multiple proportions. Law of reciprocal proportions. Gay-Lussac's Law. Avogadro's molecule hypothesis. **Atom:** Development of theory on the structure of atoms. Atom models. Atom structures. **Periodic table of elements:** Classification of elements in the periodic table. Periodic properties of elements. **Radioactivity and radioactive radiation:** Radioactive decay (*α-, β-, γ*-radiation. Natural and artificial radioactivity. Nuclear reactions and reactors. **Molecule and chemical bonds:** Definition of molecule. Chemical bonds (ionic, covalent, metallic, coordinate covalent bond). Intermolecular bonds. **States and properties of matter:** Solid state of matter (Crystalline state, Structure, Types and properties of crystals, Amorphous state of matter). Gaseous state of matter (Properties, Ideal gas equation of state, Gas laws). Liquid state of matter (Properties, Characteristic phenomena in liquid state). **Chemical kinetics:** Chemical reaction rate. Factors influencing chemical reaction rate. **Chemical equilibrium:** Basic terms. Factors influencing chemical equilibrium. **Thermochemistry:** Basic terms. Heat effect of chemical reactions. **Disperse systems:** Definition. Classification. True solutions. Colloidal dispersions. Rough-dispersed systems. **Electrolytes:** Definition. Electrolytic dissociation. Electrolysis. **Classes of inorganic compounds:** Oxides. Acids. Bases. Salts. Theories of acids and bases: Arrhenius' theory, Brønsted–Lowry protolytic theory, Lewis theory. Autoionization of water. Ionic product. *pH* value. Neutralization. Salt hydrolysis. Buffer solutions. Indicators. **Fundamentals of organic chemistry:** Basic terms. Carbon atom hybridization. Types of formulas in organic chemistry. Isomerism. Basic reaction types in organic chemistry. Functional groups. Classification of organic compounds. **Classes of organic compounds:** Alkanes. Alkenes. Alkynes. Cyclic hydrocarbons. Aromatic hydrocarbons. Alcohols and phenols. Ethers. Aldehydes. Ketones. Carboxylic acids. Carboxylic acid derivatives. Organic compounds of nitrogen and sulphur. Carbohydrates. Lipids. Proteins.

Practical lessons

Auditory/calculation exercises: Basic terms and laws in chemistry; Calculations based on chemical equations (stoichiometry). Chemical kinetics. Chemical equilibrium. Thermochemistry. Gas laws. Redox equations. Dispersion systems. Quantitative

composition of solutions (amount, mass, and molar concentration, mass, amount, and volume fraction, solution percentage). Electrolytic dissociation. Theories of acids and bases. *pH* value.

Laboratory work

Measurement of mass. Dependence of chemical reaction rate on concentration. Heat effect of dissolution. Heat effect of chemical reactions. Examination of redox reactions. Solution preparation. Determination of solution *pH* value. Volumetrics. Extraction. Distillation.

Literature

[1] Stojanović Marina, Golubović Tatjana (2014). *Osnovi opšte i neorganske hemije sa zadacima*. Niš: Univerzitet u Nišu, Fakultet zaštite na radu

[2] Mitić Marina, Popović Danilo (2003). *Osnovi organske hemije sa analitikom*. Niš: Univerzitet u Nišu, Fakultet zaštite na radu

[3] Arsenijević Stanimir (1992). *Neorganska hemija*. Beograd: Naučna knjiga Beograd

[4] Golubović Tatjana, Stojanović Marina. *Praktikum za izvođenje laboratorijskih vežbi (interni materijal za izradu vežbi).* Niš: Univerzitet u Nišu, Fakultet zaštite na radu

[5] Brown Larry, Holme Tom (2010). *Chemistry for Engineering Students*. Belmont: CA: Brooks/Cole

Number of active classes (weekly)

Lectures	3	Auditory exercises	2	Other forms of classes	0.67	RS	-	Other classes	-

Teaching methods

Lectures, auditory/calculation exercises, laboratory work, office hours

Grading (maximum number of points: 100)

Pre-exam requirements	Points	**Exam**	Points
Activity during lectures	5	Written exam (practical part of the exam)	20
Activity during exercises	5	Oral exam (theoretical part of the exam)	20
Colloquium 1	20		
Colloquium 2	20		
Topic presentation	5		
Laboratory work	5		

Course name: Safety System Fundamentals		
Course status: Required	**Course code:**	19.OZNR03
ECTS credits: 6		
Requirements: -		

Course aim

Acquisition of knowledge about the basic elements, characteristics, and processes of a system. Definition of occupational and environmental systems, determination of interdependent relationships between occupational safety, environmental protection, and fire safety.

Course outcome

Students' acquisition of skills and ability to:

- organize a systems approach to resolving occupational and environmental issues;
- monitor the interactions between elements of the system and analyze the interaction effects of organizational and natural systems;
- conduct themselves properly within the defined occupational and environmental safety systems.

Course outline

Theoretical lessons

Systems approach to studying the occupational and natural environments: Definition of a system. System relations. System description. System characteristics. System structure. System state. System process. System behaviour. System surrounding. Classification of systems. System quality. Quality measurement. System management.

Occupational and environmental system: Occupational system. Environmental system. Ecosystem as a spatial and organizational unit. Change of matter and energy in the occupational and environmental system. Connection between the occupational and environmental systems. **People as elements of the occupational and environmental system**. Characteristics of people as elements of the occupational and environmental system. Effects of work and work activities in the occupational and natural environment.

Safety and risk in the occupational and environmental system. System hazard, risk, and degradation. System reliability, safety, effectiveness, and efficiency. Risk in technological systems. Risk of accidents. Professional risk. Risk assessment methods. **Occupational safety system**. Definition of occupational safety. Subject matter and aim of occupational safety. Measures, procedures, principles and rules of occupational safety. **Environmental protection system.** Definition of environmental protection. Subject matter and aim of environmental protection. Environmental theories. Water, air, and soil pollution. Climate change. Sustainable use of energy. Waste management. Measures and procedures of environmental protection. **Fire safety and emergency management system**. Definition of fire safety. Subject matter and aim of fire safety. Subjects in the fire safety system. Measures, procedures, principles and rules of fire safety. Emergency management.

Practical lessons

Exercises follow the theoretical lessons, with added problem solving and presentation of term papers.

Literature

[1] Anđelković Branislav (2010). *Osnovi sistema zaštite*. Niš: Univerzitet u Nišu, Fakultet zaštite na radu u Nišu

[2] Stanković Miomir, Savić Suzana, Anđelković Branislav (2002). *Sistemska analiza i teorija rizika*. Beograd: Zaštita pres

Number of active classes (weekly)									
Lectures	2	Auditory exercises	2	Other forms of classes	-	RS	-	Other classes	-
Teaching methods Lectures, auditory exercises, and office hours									
Grading (maximum number of points: 100)									
Pre-exam requirements			Points	**Exam**				Points	
Activity during lectures			5	Written exam (practical part of the exam)				30	
Activity during exercises			5	Oral exam (theoretical part of the exam)				10	
Colloquium			25						
Term paper			25						

Course name: Sociology		
Course status: Required	**Course code:**	19.OZNR04
ECTS credits: 6		
Requirements: -		

Course aim

Expanding knowledge about people and society, their interrelations and processes, resulting groups and formations, social structure, social dynamics, and global change, all for the purpose of identifying, understanding, and explaining the events and processes and accepting a holistic world view that contributes to the harmonization of relations within society and the society-nature system.

Course outcome

Future engineers will be able to use their acquired knowledge to:

- reason and think critically, distinguish between and understand different types of social relations and social actions;
- better understand modern forms of social life and social issues;
- properly perceive the interaction between social phenomena and societal changes and between society and nature;
- properly perceive the positive and negative effects of globalization and economic transition.

Course outline

Theoretical lessons

Definition of the science and subject matter of sociology: Definition of the science, definition of and types of scientific laws, differentiation of the science. Natural and social sciences. Origin of sociology and its subject matter. Relationship of sociology toward other sciences. **Method of sociological research:** definition of the scientific method and methodology. Method of sociology. Research of social phenomena: research subject and formulation of hypotheses; data collection (observation; examination: survey, interview, and testing; content analysis, comparative method); data sorting and processing and scientific explanation. **Classical sociological theories:** Positivism, biologism, collective psychological theory, Marxism. **Modern sociological theories**: functionalism, theory of social conflict, global system theory, risk society theory. **Society and social phenomena:** Sociological definition of society and humans; definition of and types of social phenomena. **Social structure and dynamics**: Definition of social structure; elements of social structure. Definition of and types of social movement. **Social stratification:** slavery systems of stratification, estate systems, caste systems, and class systems. **Social groups:** People, nation, humankind, classes, family, political parties, social movements, state, village and city, profession. **Culture and society:** Sociological determination of culture, mass culture, kitsch and 'schund' (trash culture). **Social norms:** Definition of and types of social norms. Social regulations: law, morals, customs, fashion. Technical rules. **Forms of social awareness**: Religion, ethics, art, science, philosophy. **Changes in modern society:** Scientific and technological revolution and social implications; positive and negative effects of globalization and economic transition; poverty, social exclusion, and environmental issues as characteristics of modern society.

Practical lessons

Auditory exercises: analysis of relevant texts on modern social phenomena, actors of social change and mechanisms of social change/development; presentation of certain current topics: demographic changes, ecological risks, technology and society, engineering ethics, poverty and social exclusion, globalization and changes in our society, transition processes in Serbia; presentation of term papers.

Literature

[1] Miltojević Vesna, Ilić-Krstić Ivana (2020). Opšta sociologija (interni materijal za pripremu ispita). Niš: Univerzitet u Nišu, Fakultet zaštite na radu u Nišu.
[2] Vuksanović Gordana (2020). Sociologija [Elektronski izvor]. Novi Sad: Visoka poslovna škola strukovnih studija. http://vps.ns.ac.rs/.
[3] Hafner J. Petar, Mišić Slavoljub (2012). Sociologija. Niš: Univerzitet u Nišu, Ekonomski fakultet.
[4] Gidens Entoni (2006). Sociologija. Beograd: Univerzitet u Beogradu, Ekonomski fakultet.
[5] Marković Ž. Danilo (2003). Opšta sociologija. Beograd: Savremena administracija.

Number of active classes (weekly)

Lectures	2	Auditory exercises	2	Other forms of classes	-	RS	-	Other classes	-

Teaching methods

Lectures (oral exposition, discussions, presentations), exercises (individual and group work), term papers, office hours

Grading (maximum number of points: 100)

Pre-exam requirements	Points	**Exam**	Points
Activity during lectures	5	Oral exam (theoretical part of the exam)	40
Activity during exercises	5		
Colloquium	25		
Term paper	20		
Topic presentation	5		

Course name: Legal Fundamentals of Safety

Course status: Required | **Course code:** 19.OZNR05

ECTS credits: 6

Requirements: -

Course aim

Acquisition of knowledge about the basic legal institutes and elementary theoretical knowledge in legal fundamentals of safety pertaining to occupational safety, environmental protection, and fire safety, as well as competence in positive-law solutions in this field.

Course outcome

Students' ability to:

- understand how occupational safety, environmental protection, and fire safety operate on legal foundations;
- interpret acts that regulate these fields;
- practically apply the said acts.

Course outline

Theoretical lessons

Definition, subject matter, and method of Legal Fundamentals of Safety. International law for occupational and environmental safety. Fundamental UN regulations on occupational and environmental safety. International labour organizations of the EU and the European Council. **National legislation on occupational safety.** Constitution of the Republic of Serbia. Labour Law. Law on occupational safety and health. **National legislation on environmental protection.** Constitution of the Republic of Serbia. Law on environmental protection. Law on environmental impact assessment. Law on strategic environmental impact assessment. Law on integrated prevention and control of environmental pollution, laws on specially protected values. **National legislation on fire safety.** Law on fire safety. **National legislation on emergency safety.** Law on disaster risk reduction and emergency management. **National legislation on public utility management.** Law on public utility activities. Law on communal police.

Practical lessons

Auditory exercises that follow the theoretical lessons, presentation and defence of term papers on the areas covered in theoretical lessons, analysis of legislative acts, and visits to relevant institutions.

Literature

[1] Ilić Petković Aleksandra (2020). Pravni osnovi zaštite. Niš: Univezitet u Nišu, Fakultet zaštite na radu u Nišu.
[2] Ivošević Zoran (2020). Radno pravo. Beograd: Službeni glasnik.
[3] Lilić Stevan, Drenovak Ivanović Mirjana (2014). Ekološko pravo. Beograd: Univerzitet u Beogradu, Pravni fakultet
[4] Božić Trefalt Vera i dr. (2012). Osnove iz bezbednosti i zdravlja na radu i zaštite od požara. Novi Sad: Visoka tehnička škola strukovnih studija
[5] Živković Snežana (2011). Organizacija zaštite od požara. Niš: Univezitet u Nišu, Fakultet zaštite na radu u Nišu.

Number of active classes (weekly)

Lectures	2	Auditory exercises	2	Other forms of classes	-	RS	-	Other classes	-

Teaching methods Lectures (oral expositions, presentations, discussions), exercises (term papers and analyses of legislative acts), and office hours			
Grading (maximum number of points: 100)			
Pre-exam requirements	Points	**Exam**	Points
Activity during lectures	5	Oral exam (theoretical part of the exam)	40
Activity during exercises	5		
Colloquium 1	15		
Colloquium 2	15		
Term paper	20		

Course name: Physics		
Course status: Required	**Course code:**	19.OZNR06
ECTS credits: 6		
Requirements: -		

Course aim

Learning about fundamental principles and laws of physics necessary to analyze processes and phenomena in environmental, occupational safety, and fire safety engineering.

Course outcome

Students' ability to:

- understand the fundamental physical principles of classical and quantum mechanics and apply their acquired knowledge to a broad spectrum of physical phenomena in the world surrounding us;
- solve problems using the analytical approach to the modelling of physical phenomena with the use of appropriate mathematical techniques;
- apply the knowledge and skill acquired through laboratory work (measurement of physical quantities, analysis and interpretation of measurement results) to the fields of environmental protection, occupational safety, and fire safety;
- recognize the influence of physics in modern science and society: how and where physical methods and principles can help solve current issues, e.g. air pollution, noise pollution (by analyzing physical processes in the atmosphere or those necessary for identifying positive and negative aspects of noise and vibration, etc.);
- think critically and present their research results using a modern approach to physical phenomena and participate in scientific communication in oral and written form.

Theoretical lessons

Physics and measurements: Physical quantities and units. SI system. Dimensional analysis. Measurements in physics. Measurement uncertainty. Data processing and presentation of experimental results.

Kinematics: Vector and scalar quantities. Motion of a material point. Reference system. Trajectory, path, and displacement. Velocity and acceleration. Uniform motion. Motion with constant acceleration. Free fall. Projectile motion. Uniform and non-uniform circular motion. Kinematics of rotational motion. Angular velocity and acceleration.

Dynamics: Force and mass. Newton's laws of mechanics. Linear momentum and impulse of a force. Conservation of momentum. Frictional force. The fundamental forces. The concept of field. Gravity. Kepler's laws. Newton's law of universal gravitation. The gravitational field. Gravitational acceleration. Escape speed.

Work, energy, power: Work, energy, potential energy, kinetic energy. Conservation of energy. Renewable energy sources. Power.

Rigid body dynamics: Types of rigid body motion. Torque. Moment of inertia. Steiner's theorem. Basic equation of rotational motion dynamics. Static equilibrium. Equilibrium of a material point. Rigid object in equilibrium. Effect of force on a rigid body. Types of equilibriums.

Oscillations: Elasticity. Elastic properties of materials. Hooke's law. Types of elastic deformations. Periodic motion. Oscillatory motion. Period and frequency of oscillations. Mechanical oscillations (vibrations). Simple harmonic oscillations. Superposition of oscillations. Oscillation of a mass-spring system. Mathematical pendulum. Damped harmonic oscillations. Forced oscillations. Resonance. Definition of vibration and fundamental quantities in vibration theory. Degrees of freedom in vibration systems.

Impacts of vibrations on humans.

Wave motion and the concept of sound: Origin and types of mechanical waves (particularly sound waves). Plane and spherical waves equations. Wave propagation speed. Wave superposition and interference. Standing waves. Huygens' principle. Wave diffraction. Reflection. Refraction. Mechanism of sound wave generation. Sound wave pressure. Sound wave energy. Sound intensity. Sound/noise level. Subjective sound intensity. Doppler effect. Sound wave propagation phenomena. Impact of noise on humans.

Fundamentals of fluid mechanics: Fluid statics. Hydrostatic pressure. Pascal's law. Earth's atmosphere. Buoyancy. Archimedes' law. Surface tension. Phenomena at the liquid-solid boundary. Capillary action. Fluid dynamics. Fluid flow. The continuity equation. Bernoulli's equation. Torricelli's theorem. Stokes' law.

Fundamentals of molecular physics: Heat and temperature. Specific heat Thermal expansion of solids and liquids. Molecular kinetic theory. The ideal gas laws. The ideal gas equation. Phase changes and latent heat. Humidity. Evaporation. Boiling. Heat transfer. Conduction. Convection. Radiation. Greenhouse effect.

Thermodynamics: Laws of thermodynamics. Work and volume changes. Adiabatic processes for an ideal gas. Work in gas isoprocesses. The Carnot cycle. Real gases and vapours. Van der Waals equation.

Electric phenomena: Electric charge of a body. Coulomb's law. The electric field. Electric potential and potential difference. Capacitance and capacitors. Capacitor in series and parallel. Electric current. Electromotive force. Ohm's law. Resistor connection in series and parallel. Work, power, and thermal effect of electric current.

Magnetic phenomena: Magnetic field of electric current in a vacuum. Effect of magnetic fields of two parallel conductors. Magnetic properties of matter. Permanent magnets and electromagnets. Electromagnetic induction. Faraday's law of induction. Lenz's law. Self-inductance. Alternating currents. Effective value of alternating current.

Optics: Geometrical optics. Laws of geometrical optics. Reflection and refraction. Total internal reflection. Lenses, mirrors, optical instruments. Wave optics.

Fundamentals of atomic and nuclear physics: Quantization of energy and photons. Blackbody radiation. Photoelectric effect. The wave properties of particles. Models of the atoms. Spectra. Radioactivity. Types of radiation. Radioactive decay rates. Activity. Fission and fusion. Nuclear reactors. Biological effects of ionizing radiation. Protection against ionizing radiation. Standards. Detectors of nuclear radiation.

Practical lessons

Problem-solving exercises and laboratory work: Problem-solving exercises follow the theoretical lessons, thus contributing to a better understanding of the course material and expanding the acquired knowledge. Laboratory work, during which students are practically instructed to conduct basic measurements, calculations, and analyses of obtained experimental results, follow the theoretical lessons and problem-solving exercises.

Literature

[1.] Dimitrijević Predrag, Praščević Momir (2011). *Fizika – autorizovana predavanja*. Niš: Univerzitet u Nišu, Fakultet zaštite na radu u Nišu

[2.] Nešić Ljubiša (2011). *Osnovi fizike*. Niš: Univerzitet u Nišu, Prirodno-matematički fakultet

[3.] Terzić Mira, Šiljegović Mirjana (2013). *Fizika okoline-odabrana poglavlja*. Novi Sad: Univerzitet u Novom Sadu, Fakultet tehničkih nauka

[4.] Dimitrijević Predrag, Zdravković-Milošević Slavica (2006). *Praktikum eksperimentalnih vežbi iz fizike*. Niš: Univerzitet u Nišu, Fakultet zaštite na radu u Nišu

<table>
<tr><td colspan="10">[5.] Dimitrijević Predrag, Lukić Mladena, Marinković Nataša (2014). Zbirka zadataka iz fizike. Niš: Univerzitet u Nišu, Fakultet zaštite na radu u Nišu</td></tr>
<tr><td colspan="10">Number of active classes (weekly)</td></tr>
<tr><td>Lectures</td><td>3</td><td>Auditory exercises</td><td>2</td><td>Other forms of classes</td><td>0.67</td><td>RS</td><td>-</td><td>Other classes</td><td>-</td></tr>
<tr><td colspan="10">Teaching methods
Lectures, calculation exercises, and laboratory work (over 10 weeks) with a multimedia presentation and interactive work with students</td></tr>
<tr><td colspan="10">Grading (maximum number of points: 100)</td></tr>
<tr><td colspan="4">Pre-exam requirements</td><td>Points</td><td colspan="3">Exam</td><td colspan="2">Points</td></tr>
<tr><td colspan="4">Activity during lectures</td><td>5</td><td colspan="3">Written exam (practical part of the exam)</td><td colspan="2">20</td></tr>
<tr><td colspan="4">Activity during exercises</td><td>5</td><td colspan="3">Oral exam (theoretical part of the exam)</td><td colspan="2">20</td></tr>
<tr><td colspan="4">Colloquium 1</td><td>20</td><td colspan="3"></td><td colspan="2"></td></tr>
<tr><td colspan="4">Colloquium 2</td><td>20</td><td colspan="3"></td><td colspan="2"></td></tr>
<tr><td colspan="4">Laboratory work</td><td>10</td><td colspan="3"></td><td colspan="2"></td></tr>
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Course name: Computer Science Fundamentals

Course status: Required | **Course code:** 19.OZNR07

ECTS credits: 6

Requirements: -

Course aim

Acquisition of basic knowledge in arithmetic, logical, and algebraic fundamentals of computers. Capability of individual work on a computer and use of general software applications.

Course outcome

Students' acquisition of skills and ability to:

- apply computer science and information technology for independently solving safety problems using computers;
- understand the functioning of computer systems on the arithmetic and logical levels;
- solve logical problems and employ abstract reasoning using logic circuits and logical laws;
- algorithmically solve problems;
- use software tools for text processing and tabular calculations on an advanced level.

Course outline

Theoretical lessons

Arithmetic basics of computers: Number systems and number bases. Data representation in computer memory. Two's complement and one's complement. Floating and non-floating points. Realization of arithmetic operations. Conversion of numbers using tables. Conversion of numbers using class methods. Representation of character data. Representation of logical data. Codes and coding. **Logical basics of computers**: Boolean logic. Elementary logical functions and elementary logic circuits. Additional logical functions and logic circuits. Logical identities. Normal and minimal forms of logical functions. Methods of minimizing logical functions. Adders. **Architecture of personal computers**: Computer model. Hierarchic structure of computer systems. Functional parts of computer systems and their characteristics. Hardware. **Algorithmization**: Basics of algorithmization. Algorithmic block. Algorithmic structures. **Software**: System software. Files. Hierarchic structure of files. Application software. Classification of application software.

Practical lessons

They are split into two parts, which follow the theoretical lessons. Auditory and calculation exercises focus on practical examples pertaining to arithmetic and logical fundamentals of computers and algorithmic structures. Students are asked to logically describe problems using logical functions. The second part involves the solving of elementary problems using application software. The acquired knowledge is applied through practical work in a computer laboratory, whereby individual problem-solving using application software is encouraged.

Literature

[1] Krstić Dejan, Blagojević Milan, Janaćković Goran (2019). *Računarska tehnika- osnovi organizacije i primene personalnih računara*, 3. izdanje. Niš: Univerzitet u Nišu, Fakultet zaštite na radu u Nišu

[2] Janaćković Goran, Krstić Dejan, Zlatković Bojana (2015). *Zbirka zadataka iz računarske tehnike sa praktikumom*. Niš: Univerzitet u Nišu, Fakultet zaštite na radu u Nišu

Number of active classes (weekly)

Lectures	2	Auditory exercises	1	Other forms of classes	0.53	RS	-	Other classes	-

Teaching methods Lectures, calculation exercises (8 weeks) and exercises in computer laboratories (7 weeks). Exercise classes include multimedia and video presentations.			
Grading (maximum number of points: 100)			
Pre-exam requirements	Points	**Exam**	Points
Activity during lectures	5	Written exam (practical part of the exam)	10
Activity during exercises	5	Oral exam (theoretical part of the exam)	30
Colloquium 1	25		
Colloquium 2	25		

Course name: Engineering Graphics

Course status: Required	**Course code:**	19.OZNR08

ECTS credits: 6

Requirements: -

Course aim

Developing spatial perception, adopting graphic projection principles, becoming skilled in graphic communication and application of graphic and computer methods in solving engineering problems.

Course outcome

Students' acquisition of skills and ability to:

- create graphic projections using modern software tools;
- use, create, and amend technical documentation in traditional and modern formats.

Course outline

Theoretical lessons

Descriptive geometry. Projection and types of projection. Single-plane projection. Two-plane projection. Three-plane projection. Point and its projection. Line and its projection. Plane and its projection. **Interposition of point, line, and plane.** Point and plane. Line and plane. Point and line. Transformation of a point. Transformation of a plane. Transformation of a shape. Rotation. Rotation of a point. Rotation of a line. Rotation of a shape. **Shapes and their projections.** Projection of polyhedrons. Pyramids. Prisms. Projection of round shapes. Circular cones. Circular cylinders. **Plane sections of shapes and grids.** Plane section and grid of a pyramid. Section of oblique pyramid and general plane. Section of oblique pyramid and special plane. Direct penetration method. Determination of the true size of the section using the transformation and rotation methods. Plane section and grid of a prism. Section of oblique prism and general plane. Section of oblique prism and special plane. Direct penetration method. Determination of the true size of the section using the transformation and rotation methods. **Technical drawing.** Geometric constructions. Standards in technical drawing. Principles of object representation. **Computer-aided design.** AutoCAD interface. Drop-down menus and tool palettes. Command window. Status bar. Draw surface. Shop drawing procedure.

Practical lessons

Auditory exercises that follow the theoretical lessons, graphic assignments in descriptive geometry and technical drawing. Acquisition of computer-aided design skills.

Literature

[1.] Đurđanović Mihailo, Mijailović Ivan, Glišović Srđan, Kulašević Dragan (2009). *Osnovi inženjerske grafike*. Niš: Univerzitet u Nišu, Fakultet zaštite na radu u Nišu

[2.] Đurđanović Mihailo, Kulašević Dragan (2009). *Inženjerska grafika, Zbirka zadataka iz nacrtne geometrije*, Niš: Univerzitet u Nišu, Fakultet zaštite na radu u Nišu

[3.] Đurđanović Mihailo, Mijailović Ivan (2010): *Inženjerska grafika, Zbirka zadataka iz tehničkog crtanja*. Niš: Univerzitet u Nišu, Fakultet zaštite na radu u Nišu

Number of active classes (weekly)

Lectures	3	Auditory exercises	1	Other forms of classes	0.53	RS	-	Other classes	-

Teaching methods

Lectures, auditory (calculation) exercises, office hours. Interactive work with students. Use of multimedia presentations during lectures.

Grading (maximum number of points: 100)			
Pre-exam requirements	Points	**Exam**	Points
Activity during lectures	5	Written exam (practical part of the exam)	40
Activity during exercises	5		
Colloquium 1	15		
Colloquium 2	15		
Graphic assignment 1	15		
Graphic assignment 2	5		

Course name: English Language		
Course status: Required	**Course code:**	19.OZNR09
ECTS credits: 6		
Requirements: -		

Course aim

Development of receptive and productive language skills (in both written and oral form)

Course outcome

Students' ability to:

- use lexical units of the English language necessary for written and oral professional communication at an intermediate level;
- use syntactic units of the English language necessary for written and oral professional communication at an intermediate level;
- understand professional content and translate it orally and in writing from English to Serbian and vice versa.

Course outline

Theoretical lessons

English grammar: The Present Simple Tense. The Present Continuous Tense. The Present Perfect Tense. The Past Simple Tense. The Past Continuous Tense. The Passive Voice. Indirect Speech. Possessives. Comparison of Adjectives. **Vocabulary building**: General academic/scientific and specialized professional terminology covering the fields of occupational safety, environmental protection, and fire safety. **Lexicogrammatical analysis and translation of professional English texts pertaining to occupational safety:** Risks. Machine Hazards. Accidents. Noise – Acceptability Criteria. Protective Clothing. Homeostasis and Information Feedback. **Lexicogrammatical analysis and translation of professional English texts pertaining to environmental protection:** Animal Extinctions; Energy and Environmental Impacts. Intensive Agriculture. Waste in Water: Sewage. Air Pollution: Nitrogen and Sulphur Compounds. Urban Environment (Wuhan). Consumer Distrust of Green Advertising – Environmental Regulation. **Lexicogrammatical analysis and translation of professional English texts pertaining to fire safety:** Use and Storage of Inflammable Liquids. Explosions. Detection and Extinguishment.

Practical lessons

Auditory exercises that follow the theoretical lessons

Literature

[1] Tošić Jelica (2002). *Environmental Science in English.* Niš: Univerzitet u Nišu, Fakultet zaštite na radu u Nišu

[2] Tošić Jelica (2009). *Environmental Science Dictionary.* Niš: Univerzitet u Nišu, Fakultet zaštite na radu u Nišu

[3] Laban Mirjana et al. (2020). Glossary of terms in disaster risk management and fire safety / Rečnik pojmova iz upravljanja rizikom od katastrofalnih događaja i požara. Novi Sad, Fakultet tehničkih nauka.

[4] (2010) Health and Environment in Europe: Progress Assessment, World Health Organization. https://www.euro.who.int/__data/assets/pdf_file/0010/96463/E93556.pdf

[5] Alli, B. O. (2008). Fundamental Principles of Occupational Health and Safety, Second edition, International Labour Organization https://www.ilo.org/wcmsp5/groups/public/@dgreports/@dcomm/@publ/documents/publication/wcms_093550.pdf

Number of active classes (weekly)									
Lectures	2	Auditory exercises	2	Other forms of classes	-	RS	-	Other classes	-

Teaching methods
Lectures; Auditory exercises

Grading (maximum number of points: 100)			
Pre-exam requirements	Points	**Exam**	Points
Activity during lectures	5	Written exam (practical part of the exam)	20
Activity during exercises	5	Oral exam (theoretical part of the exam)	20
Colloquium 1	25		
Colloquium 2	25		
Graphic assignment 1	15		
Graphic assignment 2	5		

Course name: Safety Economics

Course status: Required | **Course code:** 19.OZNR10

ECTS credits: 6

Requirements: -

Course aim

Acquisition of necessary knowledge about the business system, business costs, safety costs, and the relations between safety costs and quality of business.

Course outcome

Students' ability to:

- assess occupational and environmental economic impact;
- consider the economic effects of investing in safety;
- manage projects of protection improvement of working and living environment based on safety costs.

Course outline

Theoretical lessons

Introduction: Activities. Production. Business. Assets. Funds. Costs. Economic principles. Results. Financial plan. Internal effects. External effects. Diseconomy. **Safety and costs:** Direct and indirect safety costs. Monitoring and reporting. Data collection. Cost management systems. Safety cost analysis. Safety as an economic category. **Direct effects of unfavourable work conditions:** Occupational injuries, fatal occupational injuries, professional diseases, work-related illnesses, and physical disability. **Economic effects of unfavourable work conditions:** Losses and damages. **Direct effects of fires and explosions:** Injuries, fatal injuries, and disability. **Economic effects of fires and explosions:** Direct and indirect damage. **Immediate effects of environmental pollution:** Diseases and fatal outcomes. **Economic effects of environmental pollution:** Direct and indirect damage. **Investing in safety**: Economic effects of investing in safety and their influence on the quality of business. **Examples of good practice**.

Practical lessons

Solving specific problems, processing economic indicators, using computer support, and analyzing economic impact using previous case studies.

Literature

[1] Spasić Dragan, Avramović Danijela (2017). Ekonomika zaštite. Niš: Univerzitet u Nišu, Fakultet zaštite na radu u Nišu.
[2] Fuller, T. P. (2019). Global Occupational Safety and Health Management Handbook. Boca Raton, FL: CRC Press, Taylor & Fransis Group.
[3] Reniers, G. L. L., Van Erp, N. H. R. (2016). Operational Safety Economics: A Practical Approach Focused on the Chemical and Process Industries. Chichester, UK: John Wiley & Sons, Ltd.
[4] Till, R. C., Coon, J. W. (2019). Fire Protection: Detection, Notification, and Suppression. Second Edition. New York, USA: Springer.
[5] Hand, M. S., Gebert, K. M., Liang, J., Calkin, D. E., Thompson, M. P., Zhou, M. (2014). Economics of Wildfire Management. New York, USA: Springer.

Number of active classes (weekly)

Lectures	2	Auditory exercises	2	Other forms of classes	-	RS	-	Other classes	-

Teaching methods

Lectures, auditory (calculation) exercises, consultations. Interactive work with students. Use of multimedia presentations during lectures.

Grading (maximum number of points: 100)			
Pre-exam requirements	Points	**Exam**	Points
Activity during lectures	5	Oral exam (theoretical part of the exam)	40
Activity during exercises	5		
Colloquium 1	25		
Colloquium 2	25		

Course name: Electrotechnics Fundamentals		
Course status: Required	**Course code:**	19.OZNR11
ECTS credits: 6		
Requirements: -		

Course aim

Acquisition of knowledge about basic terms and laws in electrotechnics.

Course outcome

Students' ability to understand phenomena and principles in electrotechnics. Acquisition of knowledge about natural laws as a theoretical foundation for future courses that focus on the application of electrical energy and protection against electrical hazards, through the following sub-fields:

- electrostatics (charge, electrostatic field);
- electrokinetics (stationary electric field and direct current);
- electromagnetism (electromagnetic phenomena, forces, electromagnetic induction and magnetization);
- time-variable currents (generation and use of alternating currents);
- fundamentals of electronics (theory of conductivity in semiconductors and basic electronic elements).

Electrostatics: Charge. Coulomb's Law. Electric field. Gauss's Law. Work. Electric scalar potential. Capacitance and capacitors. Dipole and multipoles. The image theorem. Conductors and dielectrics. Electrostatic induction vector. Boundary conditions. Dielectric polarisation. Bound charges. Electrostatic field energy. Principle of static charge elimination. **Stationary electric field and direct current:** Charge carriers. Current intensity and density. Charge continuity equation. Kirchhoff's first law. Resistance and resistors. Ohm's law. Joule's law. Electromotive force. Voltage and current generators. Capacitor in a direct current circuit. Maximum power transfer. Kirchhoff's second law. Theorems and methods for solving electric circuits. Duality of electrostatic and stationary electrostatic field. Impulse ground resistance and grounding principles. **Electromagnetism:** Lorentz force. Magnetic induction. Hall effect. Magnetic field of stationary currents. Particle movement in electromagnetic field. Ampere's Law. Circular current contour. Solenoid. Torus. Magnetic materials and material magnetizing. Boundary conditions. Material division and hysteresis. Concept of magnetic pseudo-mass and magnetic poles. Generalized Ampere's Law. Electromagnetic induction. Faraday's Law. Magnetic field energy. Inductance and induction coefficients. Mutual inductance and coupled circuits. Electrical oscillations. Direct and alternating current generators. Transformer. Variable electromagnetic field. Surface effect. **Time-variable and alternating currents:** Types of variable currents and quantities. Simple-periodic currents. Single-phase electric power. Resistance in alternating current circuits (thermogenic, inductive, and capacitive resistance). Instantaneous and average power in alternating current circuits. Series and parallel RLC circuit. Active, reactive, and apparent power. Receiver alignment with a generator. Complex representatives of alternating quantities, complex domain, complex impedance and power. Resonance and antiresonance. Solution of simple electric circuits in the time domain and the complex frequency domain. Polyphase systems. Three-phase system. Three-phase system power. Rotating magnetic field. **Fundamentals of electronics:** Zone theory of solids. Conductors, dielectrics, and use in electrotechnics. Semiconductors, PN junction, PN junction polarization. Diode – types and application. Transistor – types and application. Bipolar and MOSFET transistors. Transistor as an amplification element.

Practical lessons

Auditory exercises: Solution of calculation problems in electrostatics, direct currents, electromagnetism, and alternating currents; demonstration exercises on connecting electrical circuit elements; learning about measuring instruments; and measurement of basic electrical quantities.

Literature

[1] Petković Dejan, Krstić Dejan (2005). *Elektrostatika*. Niš: Univerzitet u Nišu, Fakultet zaštite na radu
[2] Petković Dejan, Krstić Dejan, Stanković Vladimir (2010). *Stacionarno električno polje i jednosmerna struja*. Niš: Univerzitet u Nišu, Fakultet zaštite na radu u Nišu
[3] Petković Dejan (2016). *Elektromagnetizam*. Niš: Univerzitet u Nišu, Fakultet zaštite na radu u Nišu
[4] Mitić Dragutin (2008). *Elektrotehnika I,II*. Niš: Petrograf
[5] Mitić Dragutin (2008). *Elektrotehnika I,II u obliku metodičke zbirke zadataka*. Niš: Petrograf

Number of active classes (weekly)

Lectures	3	Auditory exercises	2	Other forms of classes	-	RS	-	Other classes	-

Teaching methods

Lectures, auditory (calculation) exercises, office hours. Interactive work with students. Use of multimedia presentations during lectures.

Grading (maximum number of points: 100)

Pre-exam requirements	Points	**Exam**	Points
Activity during lectures	5	Written exam (practical part of the exam)	10
Activity during exercises	5	Oral exam (theoretical part of the exam)	30
Colloquium 1	25		
Colloquium 2	25		

Course name: Mechanical Engineering Fundamentals

Course status: Required | **Course code:** 19.OZNR12

ECTS credits: 6

Requirements: -

Course aim

Learning about basic components of machines and devices (machine elements) and about parts from a wide variety of technical branches and fields, their standard shapes and sizes, and their operating principles; acquisition of modern and generally accepted calculation and sizing methods for standard machine elements and parts.

Course outcome

Students' ability to:

- employ engineering reasoning and decision making in technical practice by connecting theoretical knowledge acquired from the study of related technical courses / to apply interdisciplinarity in their work;
- properly assess the choice of a machine element, out of multiple elements, which will perform its given function optimally from the technical and economic perspective, as well as from occupational and environmental safety perspective.

Course outline

Theoretical lessons

Fundamentals of machine design: Introduction to machine elements. Machine systems. Basic elements of statics and strength of materials – load, strain, stress, and deformation of elementary machine elements. Sizing. **Mechanical joints**: General properties and classification of mechanical joints. Threaded joints. Elastic joints. **Rotating elements**: Definition, general properties, and classification of rotating elements. Shafts and axles – definition, classification, functions, and connections with the hubs of rotating elements mounted on them. Sliding and rolling bearings. Joints. **Power transmission elements**: Definition, area of application, general properties and selection of mechanical transmission elements. Friction-drive transmission elements. Belt-drive transmission elements. Chain drive transmission elements. Gear transmission elements. Function, structure, classification, basic components, and advantages and disadvantages of hydraulic transmission elements.

Practical lessons

Calculation problems are aimed at analyzing the laws of elementary machine elements' quiescence, stress state, and deformation state, as well as their sizing.

Literature

[1] Miltenović Vojislav (2009). *Mašinski elementi – oblici, proračun primena*. Niš: Univerzitet u Nišu, Mašinski fakultet

[2] Mitić Slavka (2009). *Tehnička mehanika*. Niš: Univerzitet u Nišu, Fakultet zaštite na radu u Nišu

Number of active classes (weekly)

Lectures	3	Auditory exercises	2	Other forms of classes	-	RS	-	Other classes	-

Teaching methods

Lectures, auditory (calculation) exercises, office hours. Interactive work with students. Use of multimedia presentations during lectures.

Grading (maximum number of points: 100)			
Pre-exam requirements	Points	**Exam**	Points
Activity during lectures	5	Written exam (practical part of the exam)	20
Activity during exercises	5	Oral exam (theoretical part of the exam)	20
Colloquium 1	25		
Colloquium 2	25		

Course name: Technological Systems and Safety		
Course status: Required	**Course code:**	19.OZNR13
ECTS credits: 6		
Requirements: -		

Course aim

Acquisition of basic knowledge about technological systems with the purpose of minimizing the risk of occupational and environmental impact by establishing critical points in relation to the reduction of waste materials and released energy and with the purpose of preventing degradation and threats to the work and natural environment.

Course outcome

Students' acquisition of skills and ability to:

- understand how technological systems work;
- identify hazards and harms in technological processes;
- control processes and operations in relation to occupational safety, environmental protection, and fire safety.

Course outline

Theoretical lessons

Technological systems – occupational and natural environment: Definition, characteristics, and classification of technological systems. Occupational and natural environment. **Mechanical operations:** Basic parameters of motion transfer mechanisms. Mixing. Grinding. Screening. Pressing. Sedimentation. Filtration. Centrifuge. Solid material transport. **Thermal processes:** Basic parameters of heat transfer mechanisms. Heat exchangers. Cookers. **Diffusion processes:** Basic parameters of mass transfer mechanisms. Distillation. Rectification. Absorption. Adsorption. Extraction. Drying. **Balancing of technological systems to reduce the risk of threats to the occupational and natural environment:** Mass balance of technological systems. Energy balance of technological systems. Exergy balance of technological systems. **Selection of input and output elements of technological processes relevant for occupational safety, environmental protection, and fire safety:** Selection of a technological process schematic. Selection of technological equipment. Selection of raw and auxiliary materials. Selection of energy. Selection of location for the technological process. Selection of chemical reactions in manufacturing technological systems. **Safety in technological systems**: Occupational safety in technological systems. Fire safety in technological systems. Technological systems as environmental pollution sources.

Practical lessons

Auditory and calculation exercises that successively follow the theoretical lessons and involve the analysis of practical examples of occupational safety, environmental protection, and fire safety in technological systems. Presentation of term papers on a given topic pertaining to integrated safety systems in technological systems. Students are encouraged to conduct research within the industry practice.

Literature

[1] Krstić Ivan (2018). *Tehnološki sistemi i zaštita*. Niš: Univerzitet u Nišu, Fakultet zaštite na radu u Nišu

[2] Cvijović Svetomir, Bošković Nevenka, Pjanović Rada (2007). *Mehaničke operacije*. Beograd: Akademska misao

[3] Cvijović Svetomir, Bošković Nevenka, Pjanović Rada (2007). *Toplotne operacije*. Beograd: Akademska misao

[4] Cvijović Svetomir, Bošković Nevenka, Pjanović Rada (2007). *Difuzione operacije*. Beograd: Akademska misao

Number of active classes (weekly)									
Lectures	2	Auditory exercises	2	Other forms of classes	-	RS	-	Other classes	-

Teaching methods
Lectures, auditory (calculation) exercises, office hours. Interactive work with students.

Grading (maximum number of points: 100)			
Pre-exam requirements	Points	**Exam**	Points
Activity during lectures	5	Written exam (practical part of the exam)	10
Activity during exercises	5	Oral exam (theoretical part of the exam)	30
Colloquium	30		
Term paper	20		

Course name: Risk from Hazardous Materials		
Course status: Required	**Course code:**	19.OZNR14
ECTS credits: 6		
Requirements: -		

Course aim

Acquisition of knowledge about hazardous materials and protective measures during their production, storage, transport, and use.

Course outcome

Students' acquisition of skills and ability to:

- identify hazardous materials;
- assess the risk from hazardous materials;
- take prevention, repression, and mitigation measures during hazardous material production, storage, transport, and use.

Course outline

Theoretical lessons

Hazardous materials: Definition and classification. Effects and impact of hazardous materials on humans and the environment. Types of hazmat accidents (biological, nuclear, chemical). **Properties of hazardous materials**: Physical and chemical properties. Properties in terms of flammability and explosiveness. Toxic, radioactive, and corrosive properties. Properties in terms of biological effects. **Identification of hazardous materials**: Databases on hazardous materials. Identification numbers. Hazard diamond. Hazard signs. Safety symbols. Waring and notice signs. Hazmat labels/placards. Hazmat plates. **Hazardous material handling**: Production of hazardous materials. Packaging (labelling of packages and containers). Hazardous material manipulation. Storage and transport of hazardous materials (international agreements concerning transport of hazardous materials, labelling of vehicles for transport of hazardous materials). **Explosive materials**: Classification. Commercial explosives. Detonators. Risk from explosive materials. Effects of explosions and their products on humans and the environment. Production and manipulation. Hazmat labels/placards and plates. Transport of explosive materials. **Compressed, liquefied, and dissolved gases**: Classification. Risk, packaging, and storage of gases. Containers for compressed gases and dissolved gases. Labelling of gases, hazmat labels/placards and plates. Transport of gases. **Flammable liquids**: Mechanism of liquid combustion. Classification, risk, and hazard zones of fire breakout and propagation. Packaging and labelling of containers containing flammable liquids. Manipulation, storage, transport, and labelling of vehicles for transport of flammable liquids. **Flammable solid materials**: Mechanism of solid material combustion. Dust combustion. Classification of flammable solid materials. Spontaneously combustible materials. Materials which, in contact with water, emit flammable gases. Risk, packaging and storage of solid materials. Hazmat labels/placards and plates. Transport of solid materials. **Oxidizing materials**: Classification. Hazmat labels/placards and plates. Labelling of vehicles and transport. **Organic peroxides**: Classification. Hazmat labels/placards and plates. Labelling of vehicles and transport. **Toxic materials**: Classification. Hazmat labels/placards and plates. Labelling of vehicles and transport. **Infectious materials:** Classification. Hazmat labels/placards and plates. Labelling of vehicles and transport. **Radioactive materials**: Packaging and storage. Hazmat labels/placards. **Corrosive materials**: Packaging, storage. Hazmat labels/placards. **Analysis and assessment of risk from hazardous materials**: Data collection and processing. Exposure assessment. Harm and toxicity assessment. Risk characterization. Management of hazardous materials.

Practical lessons

Calculation exercises: Calculation of properties of explosive and flammable materials.
Term papers: Presentation and defence of project assignments and term papers on a selected topic followed by a discussion.

Literature

[1] Pešić Dušica (2019). Rizik od opasnih materija - interni materijal za pripremu ispita. Niš: Univerzitet u Nišu, Fakultet zaštite na radu u Nišu
[2] Radić Vlado (2011). Opasne materije. Beograd: Pan-Plast.
[3] Guidance on Information Requirements and Chemical Safety Assessment Part E: Risk Characterisation (2016). Helsinki: European Chemicals Agency.

Number of active classes (weekly)

Lectures	2	Auditory exercises	2	Other forms of classes	-	RS	-	Other classes	-

Teaching methods

Lectures (oral exposition, multimedia presentations, discussions), exercises (calculation problems, individual presentation of project assignments and term papers with a discussion), office hours.

Grading (maximum number of points: 100)

Pre-exam requirements	Points	**Exam**	Points
Activity during lectures	5	Oral exam (theoretical part of the exam)	40
Activity during exercises	5		
Colloquium 1	15		
Colloquium 2	15		
Term paper 1	10		
Term paper 2	10		

Course name: Systems and Risk Modelling		
Course status: Required	**Course code:**	19.OZNR15
ECTS credits: 6		
Requirements: -		

Course aim

Acquisition of knowledge about the fundamental principles and laws of systems and risk modelling and bout their application in risk management.

Course outcome

Students' acquisition of skills and ability to:

- understand the principles and laws of system behaviour;
- understand the significance, elements, and processes of system risk management;
- apply a systemic approach in the analysis and solution of multidisciplinary problems of risk management and use tools during the analysis;
- describe systems using mathematical models;
- hierarchically model and rank risks;
- use simulation software to implement mathematical models.

Course outline

Theoretical lessons

General systems theory: Principles and laws. **Basic system terms**: System, quality, management. **Systems analysis**: Phases and functions of systems analysis. System dynamics. **System**: System representation. System transformation. System transformation matrices. System structure (static and dynamic structure). **System modelling**: System model. Model classifications. Simulation models. Mathematical models. Models in the form of differential equations. State-space models. Transfer function models. Analogies in mathematical modelling. **Graphic models**: Block diagram. Signal flow graph. Graph algebra. **Management**: Definition, elements, and principles of management. Management systems (open and closed systems). Feedback. Function test. system's response to function test. System stability. Basic dynamic elements of a management system. **Risk theory**: Objective and subjective basis of risk. Risk perspectives. Risk scenario. Risk diagram. Risk matrix. Risk indicators, quantification, and classification. Systems understanding of risk. Aspects of risk. Emergencies. **Risk models**: Modelling principles. Hierarchic modelling. Influence diagrams. Risk ranking, multi-objective analysis. Risk metrics. Risk dynamics. **Risk management**: Approaches, strategies, characteristics, elements, and processes of risk management. Risk management systems. Standardization of risk management. Elements and particularities of risk management system functioning. Safety, resilience. Risk management and decision making.

Practical lessons

Auditory and calculation exercises that follow the theoretical lessons, focusing on representations of systems using mathematical models and simulation charts. Presentation of term papers in fields covered by the theoretical content of the course and application of simulation software to create elementary models. Students are encouraged to conduct research studies involving descriptions of problems using mathematical models.

Literature

[1] Samardžić Biljana, Zlatković Bojana (2018). *Automatsko upravljanje*. Niš: Univerzitet u Nišu, Prirodno-matematički fakultet

[2] Janaćković Goran, Zlatković Bojana (2018). *Zbirka zadataka iz teorije sistema i rizika*. Niš: Univerzitet u Nišu, Fakultet zaštite na radu u Nišu

[3] Savić Suzana, Stanković Miomir (2012). *Teorija sistema i rizika*. Niš: Univerzitet u Nišu, Fakultet zaštite na radu u Nišu
[4] Keković Zoran i dr. (2011). *Procena rizika u zaštiti lica, imovine i poslovanja.* Beograd: Centar za analizu rizika i upravljanje krizama
[5] Antić Dragan (1999). *Priručnik za modeliranje i simulaciju dinamičkih sistema*. Niš

Number of active classes (weekly)

Lectures	2	Auditory exercises	2	Other forms of classes	0.13	RS	-	Other classes	-

Teaching methods

Lectures, auditory/calculation exercises, and office hours.

Grading (maximum number of points: 100)

Pre-exam requirements	Points	**Exam**	Points
Activity during lectures	5	Written exam (practical part of the exam)	40
Activity during exercises	5		
Colloquium 1	20		
Colloquium 2	20		
Term paper	10		

Course name: Chemical Parameters of Occupational and Environmental Quality		
Course status: Required	**Course code:**	19.OZNR16
ECTS credits: 6		
Requirements: -		

Course aim

Acquisition of knowledge about the chemical parameters used in the analysis of states, processes, and procedures of evaluating occupational and environmental quality and learning about their essential functional application in the comparative analysis of representative results of occupational and environmental chemical pollution.

Course outcome

Students' ability to:

- determine the pollution level of the occupational and natural environment;
- understand the qualitative and quantitative evaluation of occupational and environmental quality according to standard values of analyzed chemical parameters.

Course outline

Theoretical lessons

Occupational and environmental pollutions. Definitions and classifications. **Occupational and environmental chemical parameters (definition, classification):** Thermodynamic parameters. Kinetic parameters. Parameters of chemical and physical equilibrium. Colligative parameters. Colloidal dispersion parameters. Electrochemical parameters. **Physical parameters of a substance**: Boiling temperature. Melting temperature. Evaporation. Density. Solubility. Optical parameters. Basic meteorological terms. Quantitative composition of mixtures. Toxic occupational and environmental parameters. **Chemical parameters of air**: Meteorological parameters influencing air pollution level (wind, precipitation, solar radiation, temperature, pressure, and air humidity). Chemical parameters of emissions. Chemical parameters of ambient air pollution and transport. Combined effect of air pollution. **Chemical parameters of water**: Colloidal dispersion, colligative, chemical thermodynamic, chemical kinetic, electrochemical, sorption, and radioactive parameters. Parameters of water reactions. Parameters of drinking, natural, and wastewater quality. **Chemical parameters of soil**: Solid, liquid, and gaseous phase of soil. Colligative, colloidal dispersion, thermodynamic, kinetic, sorption, radioactive, and mineralogical parameters of soil reaction. **Fire and explosion chemical parameters**: Fires (classification, melting temperature, boiling temperature, vapour density, combustibility groups, flash point, ignition point, autoignition temperature, explosive limits). Minimum oxygen concentration. Self-heating and smouldering temperature and minimum ignition energy. Normal burn rate. Combustion rate. Explosive pressure. Flammability potential. Oxygen index. Flame spread index. Smoke generation coefficient.

Practical lessons

Basic meteorological terms (International system of units. Calculation using quantities and units. Measurement methods. Measuring instruments). **Quantitative composition of mixtures**. **Quantitative relationship of chemical parameters**. Determination of substance concentrations in air, water, and soil, and determination of basic physicochemical parameters: temperature, colour, odour, pH, conductivity, turbidity.

Literature

[1] Danilo Popović, Đorđević Amelija (2014). Hemijski parametri kvaliteta radne i životne sredine – interni materijal za pripremu ispita. Niš: Univerzitet u Nišu, Fakultet zaštite

na radu u Nišu.
[2] Veselinović Dragan, Gržetić Ivan, Đarmati Šimon, Marković Dragan (1995): Fizičko hemijske osnove zaštite životne sredine, knjiga I Stanja i procesi u životnoj sredini. Beograd: Univerzitet u Beogradu, Fakultet za fizičku hemiju.
[3] Marković Dragan, Đarmati Šimon, Gržetić Ivan, Veselinović Dragan (1996): Fizičko hemijske osnove zaštite životne sredine, knjiga II, Izvori zagađivanja posledice i zaštita. Beograd: Univerzitet u Beogradu, Fakultet za fizičku hemiju.
[4] Holclajtner-Antunović Ivanka (2012). Opšti kurs fizičke hemije. Beograd: Zavod za udžbenike.
[5] Kleut Nikola (2013). Požari i njihova dejstva. Beograd/Zemun: AGM knjiga.

Number of active classes (weekly)

Lectures	2	Auditory exercises	2	Other forms of classes	0.27	RS	-	Other classes	-

Teaching methods: Lectures, auditory exercises, laboratory work.

Grading (maximum number of points: 100)

Pre-exam requirements	Points	**Exam**	Points
Activity during lectures	5	Oral exam (theoretical part of the exam)	40
Activity during exercises	5		
Colloquium 1	20		
Colloquium 2	20		
Term paper	10		

Course name: Thermodynamics and Thermotechnics		
Course status: Required	**Course code:**	19.OZNR17
ECTS credits: 6		
Requirements: -		

Course aim

Firm grasp of the basic terms of thermodynamics, thermodynamic systems, state functions and process functions, thermal properties of materials and universal laws of thermodynamics for energy transformation, heat transfer mechanisms, operating principles of protective equipment, and basic calculations of thermotechnical devices, which serve as bases for extending the knowledge through other subsequent courses.

Course outcome

Students' ability to:

- calculate thermodynamic state and process functions of an ideal gas and gas mixtures;
- interpret the first and second laws of thermodynamics, thermodynamic cycle, thermodynamic efficiency, and the basics of real gases and vapours;
- calculate the quantities of heat transfer, conduction, convection, and radiation through flat, cylindrical, and spherical surfaces, and calculate the basic parameters of heat exchanger mass and energy balance;
- describe the operating principles of boilers, chimneys, chillers, and heat pumps and the basics of combustion;
- analyze hazards during work with thermotechnical devices and understand the role of measurement, control, and protective equipment.

Course outline

Theoretical lessons

Fundamentals of thermodynamics: Thermodynamic system and the surrounding. Working substance. State functions. Thermodynamic equilibrium. Zeroth law of thermodynamics. Gas laws. Equation of state for an ideal gas. Mixture of ideal gases. Molar mass and gas constant of a mixture. Partial pressures of components. Relationships between mixture components. **Working substance energy:** Internal energy. Quantity of heat. Heat capacity. Mayer's equation. Dependence of heat capacity on temperature. Heat capacity of a gas mixture. **First law of thermodynamics**: Change of state, state of equilibrium and non-equilibrium. Work PV diagram, reversible and irreversible processes. Definition and mathematical expression of the first law of thermodynamics. General polytropic change of state equation. Special cases of change of state. Quantity of heat and work during the change of state of an ideal gas. Relationship between quantity of heat and work with the change of ideal gas temperature, damping process and enthalpy. **Second law of thermodynamics:** Definition of the second law of thermodynamics. Cyclic processes. Right-going and left-going cyclic processes. Properties of state functions and change of state functions. Mathematical expression of the second law of thermodynamics. Entropy. T-s diagram. Thermodynamic efficiency. Carnot's cycle. Cycles: *Joule-Brayton, Otto, Diesel, Sabathe*. Entropy changes in irreversible processes. Maximum work and Nernst theorem. Free enthalpy and free energy. Exergy and anergy. **Fundamentals of real gases and vapours:** Thermodynamic properties of gases and liquids. Van der Waals equation of state for real gases. Water vapour – basic state functions of boiling water. Wet saturated, dry saturated, and superheated steam. **Heat transfer:** Isothermal surfaces, temperature gradient. Conduction. Convection. Cases of single- and multi-layer plane, cylindrical, and spherical walls. Combined conduction and convection heat transfer. Thermal radiation.

Radiation laws. Heat exchange via radiation. Protection against thermal radiation – thermal covers. **Fundamentals of thermotechnics:** Classification of heat exchangers. Exchangers with parallel, counter, and cross flow. Water equivalent and heat transfer coefficient. Logarithmic mean temperature difference. Calculation of final temperatures and surface area of heat exchangers. Efficiency of heat exchangers. Basics of combustion, elementary and technical analysis. Calorific value of fuels. boilers – classification and characteristics. Basic calculations of boiler capacity and fuel consumption. Chimneys – classification and purpose, basic chimney calculations. Basic processes in chillers. Heat pumps, operating principles and application.

Practical lessons

Calculation exercises follow the theoretical lessons; project assignment on the topic of combustion.

Literature

[1] Malić Dragutin (1975). *Termodinamika i termotehnika.* Beograd: Građevinska knjiga
[2] Živković Ljiljana, Raos Miomir (2005). *Termopostrojenja – zbirka zadataka*. Niš: Univerzitet u Nišu, Fakultet zaštite na radu u Nišu
[3] Đurić Vojislav, Bogner Martin (1980). *Parni kotlovi - teorijske osnove i proračuni*. Beograd: Građevinska knjiga
[4] Mihajlović Radomir, Živković Ljiljana, Živković Nenad (1994). *Termopostrojenja*. Niš: Univerzitet u Nišu, Fakultet zaštite na radu u Nišu
[5] Çengel Yunus, Boles Michael (2015). *Thermodynamic – engineering approach*. USA: McGraw-Hill

Number of active classes (weekly)

Lectures	2	Auditory exercises	2	Other forms of classes	-	RS	-	Other classes	-

Teaching methods

Lectures, calculation exercises, office hours.

Grading (maximum number of points: 100)

Pre-exam requirements	Points	**Exam**	Points
Activity during lectures	5	Written exam (practical part of the exam)	20
Activity during exercises	5	Oral exam (theoretical part of the exam)	20
Colloquium 1	20		
Colloquium 2	20		
Project assignment	10		

Course name: Technical Materials

Course status: Required | **Course code:** 19.OZNR18

ECTS credits: 6

Requirements: -

Course aim

Acquisition of knowledge about technical materials and their place and role in the system of humans, their surroundings, and material products.

Course outcome

Students'

- knowledge of main classes of technical materials, their generic properties, and their areas of application;
- understanding of basic relations between the structure and the properties of materials;
- understanding of fundamental methods of material examination;
- command of methods for proper selection of materials.

Course outline

Theoretical lessons

Technical materials – definition, resources, and global consumption. Critical materials. **Organization and classification of materials and processes.** Families and classes of materials. Generic properties. **Atomic structure and interatomic bonding.** Quantum mechanical model of the atom. Primary and secondary bonds. **Crystal structures.** Basic concepts. Unit cell. Cubic crystal structures. Ionic crystals. Covalent crystals. Molecular crystals. **Mechanical properties of materials**. Tensile testing, hardness, flexural strength, impact testing, fracture of materials, material fatigue, creep. **Thermal properties of materials**. Heat capacity. Thermal expansion. **Phase diagrams.** Basic concepts. Interpretation of binary phase diagrams for common alloys. **Metals and metal alloys**. Steels, cast irons, copper and copper alloys, aluminium and aluminium alloys – properties and application. **Ceramic materials.** Classification, properties, and application. **Polymeric materials.** Classification, properties, and application. **Composite materials.** Classification, properties, and application. **Electrotechnical materials**. Classification, properties, and application. **Degradation of materials**. Corrosion of metals. Degradation of polymers and ceramics. **Selection of materials.** Overview of methods. **Environmental impact of materials and their production and processing.**

Practical lessons

Expansion of knowledge acquired from theoretical lessons; calculation problems that follow the theoretical lessons

Literature

[1] Mitić Dragan (2000). *Tehnički materijali*. Niš: Univerzitet u Nišu, Fakultet zaštite na radu u Nišu

[2] Callister William, Rethwisch David (2007). *Materials science and engineering: an introduction*. John Wiley & Sons

[3] Ashby Michael, Shercliff Hugh, Cebon David (2018). *Materials: engineering, science, processing and design*. Butterworth-Heinemann

[4] Askeland Donald, Wright Wendelin (2013). *Essentials of materials science & engineering*. Cengage Learning

Number of active classes (weekly)

Lectures	2	Auditory exercises	2	Other forms of classes	-	RS	-	Other classes	-

Teaching methods Verbal-textual method (exposition, discussion, written materials), illustrative-demonstrational (power point presentations, animations, simulations), and calculation exercises.			
Grading (maximum number of points: 100)			
Pre-exam requirements	Points	**Exam**	Points
Activity during lectures	5	Oral exam (theoretical part of the exam)	40
Activity during exercises	5		
Colloquium 1	25		
Colloquium 2	25		

Course name: Safety Statistics		
Course status: Required	**Course code:**	19.OZNR19
ECTS credits: 6		
Requirements: -		

Course aim

Acquisition of knowledge concerning statistical analysis necessary for data processing in occupational safety, environmental protection, and fire safety.

Course outcome

Students' acquisition of skills and ability to:

- observe phenomena and processes in statistical terms;
- practically apply statistical methods;
- use application software in statistical analysis.

Course outline

Theoretical lessons

Descriptive statistical analysis: Population and sample. Data collection. Tabular and graphic representation of data. Estimation of a population mean. Measures of statistical dispersion. Use of software (Excel, SPSS) for statistical analysis of phenomena in the fields of occupational safety, environmental protection, and fire safety. **Probability:** Events and event algebra. Definition of probability. Conditional probability. Formula of total probability. Bayesian formula. **Random variables:** Discrete random variable. Binomial and Poisson distribution. Continuous random variable. Normal, Student and χ-squared distribution. **Statistics:** Point estimation of numerical properties of characteristics. Interval estimation of characteristic distribution parameters. Testing of statistical hypotheses. Pearson's χ^2-test. **Regression and correlation:** Linear regression. Least-squares method. Correlation. Nonlinear dependence models – power model and exponential model.

Practical lessons

Practical lessons follow the theoretical lessons and include the solving of calculation problems and processing of real data using application software.

Literature

[1] Ristić Miodrag, Popović Biljana, Đorđević Miodrag (2006). *Statistika za studente geografije*. Niš: Univerzitet u Nišu, Prirodno-matematički fakultet

[2] Popović Biljana, Ristić Miroslav (2001). *Statistika u psihologiji*. Beograd: Mrlješ

[3] Popović Biljana, Ristić Miodrag (2001). *Statistika u psihologiji - dodatak*. Beograd: Mrlješ

[4] Đolović Ivana (2011). *Zbirka zadataka iz statistike*. Bor: Univerzitet u Beogradu, Tehnički fakultet u Boru

Number of active classes (weekly)

Lectures	2	Auditory exercises	2	Other forms of classes	0.27	RS	-	Other classes	-

Teaching methods

Lectures, auditory (calculation) exercises, office hours. Interactive work with students.

Grading (maximum number of points: 100)

Pre-exam requirements	Points	**Exam**	Points
Activity during lectures	5	Written exam (practical part of the exam)	20
Activity during exercises	5	Oral exam (theoretical part of the exam)	20
Colloquium	30		
Term paper	20		

Course name: Electromagnetic Radiation		
Course status: Required	**Course code:**	19.OZNR23
ECTS credits: 6		
Requirements: -		

Course aim

Acquisition of knowledge about the basic terms and laws of electromagnetism and electromagnetic wave and corpuscular radiation.

Course outcome

Students' ability to understand the phenomena and principles pertaining to:

- electromagnetic fields and sources in the occupational environment;
- electromagnetic waves and non-ionizing radiation;
- optical quantum corpuscular radiation (UV, VIS, IR);
- electromagnetic ionizing radiation;
- effects and impact of all types of radiation on the material environment, particularly on people and their health.

Course outline

Theoretical lessons:

Electromagnetic (EM) fields: Introduction to physical quantities of field and energy. Physical interpretation of gradient, divergence, and rotor. Electrostatic polje. Electric induction vector. Third Maxwell's equation. Magnetic field. Magnetic induction flux. Fourth Maxwell's equation. Magnetic field in the matter. Ampere's law generalization. Dielectric shift current. First Maxwell's equation. Electromagnetic induction. Faraday's law generalization. Second Maxwell's equation. Stationary electric field. Charge continuity equation. Ohm's law in local form. Complete system of equations of macroscopic EM field in stationary environments. **Electromagnetic waves and electromagnetic radiation**: Wave equation for potentials and transfer speed of EM disturbance. Solution of wave equation, solution analysis, plane, cylindrical, and spherical waves. Simple periodical EM waves and Helmholtz equation. Helmholtz equation solution. EM wave properties in dielectrics, semi-conductive, conductive, and ionized environments. Reflection, transmission, and absorption of EM waves. **Electromagnetic radiation**: Electric dipole and the electric component of EM wave. Current element and magnetic component of EM wave. Hertzian dipole and dipole as a harmonic oscillator. Radiation zones and dipole radiation characteristics. **Corpuscular quantum radiation:** Optical radiation. Wave-quantum laws of radiation. IR radiation (thermal radiation). Corpuscular quantum motion in atoms. Thermal radiation laws. UV radiation. Visible radiation. Laws of radioactive decay and absorption. Ionizing radiation. **Effects of electromagnetic radiation on the material environment**: Natural sources of electromagnetic radiation in the environment. Artificial sources of electromagnetic radiation. RF radiation. Laser radiation. From non-ionizing to ionizing radiation. Biological effects of EM field and EM radiation on humans. Principle of measurement and testing of EM radiation. Dosimetry of non-ionizing and ionizing radiation. Safety measures.

Practical lessons

Auditory exercises: Practical lessons comprise calculation exercises, which expand the units from theoretical lessons through solving calculation problems, improve students' understanding and their level of knowledge acquisition, thus providing them with complete theoretical and practical knowledge, and demonstrate the use of EM field measuring instruments.

Literature

[1] Petković Dejan, Krstić Dejan, Stanković Vladimir (2008). *Elektromagnetni talasi i zračenje* (Elektromagnetna zračenja – Izvodi sa predavanja i vežbi - Sveska 5). Niš: Univerzitet u Nišu, Fakultet zaštite na radu u Nišu

[2] Krstić Dejan (2020). *Elektromagnentna zračenja u životnoj sredini*. Niš: Univerzitet u Nišu, Fakultet zaštite na radu

[3] Veličković Dragan (1997). *Elektromagnetna zračenja*. Niš

[4] Petković Dejan (2016). *Elektromagnetizam* (Elektromagnetna zračenja – Izvodi sa predavanja i vežbi – Sveska 3). Niš: Univerzitet u Nišu, Fakultet zaštite na radu u Nišu

[5] Popović Đ. Branko (1965). *Zbornik rešenih problema iz elektromagnetike*. Beograd. Građevinska knjiga

Number of active classes (weekly)

Lectures	2	Auditory exercises	2	Other forms of classes	-	RS	-	Other classes	-

Teaching methods

Lectures, auditory (calculation) exercises, office hours. Interactive work with students. Use of multimedia presentations during lectures.

Ocena znanja (maksimalni broj poena 100)

Pre-exam requirements	Points	**Exam**	Points
Activity during lectures	5	Written exam (practical part of the exam)	15
Activity during exercises	5	Oral exam (theoretical part of the exam)	25
Colloquium 1	25		
Colloquium 2	25		

Course name: Energy and the Environment		
Course status: Required	**Course code:**	19.OZZS01
ECTS credits: 6		
Requirements: -		

Course aim

Acquisition of knowledge about energy, transformation, and environmental impact of energy use. Understanding of the importance of energy in societal development, production and consumption, prospects of using conventional and renewable energy, and legal and international framework of the relationship between energy and the environment. Application of acquired knowledge as a basis to be upgraded during later years and levels of study.

Course outcome

Students' ability to interpret:

- the phenomena of energy, its definitions, forms, classifications, characteristics and manifestations, energy potential, global and local resources, and energy conversion and consumption;
- the phenomena of fossil and renewable energy sources, environmental, health, and climate impacts of conversion and consumption, advantages and disadvantages;
- the phenomena of acid rain, greenhouse effect, and ozone holes;
- energy indicators, elements of energy management, and legislation in this field;
- conclusions from international conferences on energy and climate, strategies, and directions of energy industry development in relation to the environment.

Course outline

Theoretical lessons

Definition and types of energy, Definitions, characteristics, forms, and classifications of energy. General law of energy conservation. Resources and natural resources. **Energy:** Energy production and consumption and social development. Energy – developed and underdeveloped world. Perspectives and the state of non-renewable and renewable energy resources. **Fuels**: Fossil fuels, definition, classifications. Liquid and gaseous fuels. Solid fuels. Wood. Coal. Environmental impact of fossil fuel use. Environmental impact of coal exploitation. Coal ash landfills. Soil remediation. Recultivation of abandoned open-pit mines. Conservation of abandoned mines. **Hydropower**: Water energy, definition, classifications. Hydropower stations, classifications, operation principle. Hydropower stations and the environment. Advantages and disadvantages of use. Small hydropower stations. Hydropower stations at seas and oceans. **Solar energy**: Solar radiation, definition. Global, direct, diffuse, and reflected radiation. Solar energy potential and conversion possibilities. Solar energy receivers, classification, operation principle. Conversion of solar energy into thermal and electric energy. Solar power stations. Solar energy and the environment. Advantages and disadvantages of use. **Biomass energy**: Definition, classifications, energy potential, and conversion possibilities of biomass energy. Biomass energy and the environment. Advantages and disadvantages of biomass use. **Wind energy**: Definition, classifications, historical aspect of use. Energy potential of wind. Wind generators, classifications, operation principle. Wind energy and the environment. Advantages and disadvantages of use. **Geothermal energy**: Definition and instances of geothermal energy. Basics of Earth's geothermal energy balance. Energy potential and possibilities for use. Heat pumps. Geothermal power stations. Geothermal energy and the environment. Advantages and disadvantages of use. **Nuclear energy**: Definition. Energy potential and possibilities for use. Nuclear reactions. Nuclear power stations, classifications of, operation principle. Nuclear reactor. Nuclear

energy and the environment. Advantages and disadvantages of use. **Energy balances**: Definition and types of energy balance. National, regional, and local energy balance. Energy balance of processes. Electric energy balance. Losses in electric energy production and distribution. **Energy, economy, and climate change**: Global energy consumption. Economic and geopolitical aspects. Energy crises. Energy savings and rational use. Impact of fossil fuel use on climate change. Greenhouse effect and ozone holes, acid rain. **Prospects of renewable energy use**: Estimation of the future of energy renewables. New utilization technologies. Cogeneration and trigeneration. **Regulatory framework:** Strategy of environmental conservation and improvement. Sustainable development. Energy and international documents on environmental protection. International conventions and protocols. Energy management. Strategy of energy development of Serbia. Energy indicators.

Practical lessons

Auditory exercises follow the theoretical lessons. Term papers on topics pertaining to energy and the environment.

Literature

[1] Mitić Dragan (2010). *Energija*. Niš: Univerzitet u Nišu, Mašinski fakultet

[2] Gvozdenac Dušan, Nakomčić-Smaragdakis Branka, Gvozdenac-Urošević Branka (2010). *Obnovljivi izvori energije.* Novi Sad: Univerzitet u Novom Sadu, Fakultet tehničkih nauka

[3] Đurić Milenko, Đurišić Željko, Čukarić Aleksandar (2014). *Elektrane*. Beograd: KIZ centar

[4] Lambić Miroslav (2007). *Energetika*. Zrenjanin: Univerzitet u Novom Sadu, Tehnički fakultet „Mihajlo Pupin"

[5] Mandal Šahin, Mihajlović-Milanović Zorana, Nikolić Milenko, *Ekonomika energetike - Strategija, ekologija i održivi razvoj*. Beograd: Univerzitet u Beogradu, Ekonomski fakultet

Number of active classes (weekly)

Lectures	2	Auditory exercises	2	Other forms of classes	-	RS	-	Other classes	-

Teaching methods

Lectures, auditory exercises, conversations, discussions, office hours

Grading (maximum number of points: 100)

Pre-exam requirements	Points	**Exam**	Points
Activity during lectures	5	Written exam (practical part of the exam)	20
Activity during exercises	5	Oral exam (theoretical part of the exam)	20
Colloquium 1	15		
Colloquium 2	15		
Term paper	20		

Course name: Waste Management

Course status: Required | **Course code:** 19.OZZS02

ECTS credits: 6

Requirements: -

Course aim

Acquisition of knowledge and skills for development and implementation of integral sustainable waste management system, local and regional waste management planning, and development of best practice in waste management in order to reduce the negative effects of waste (municipal, industrial, hazardous, etc.).

Course outcome

Students' ability to:

- understand the processes in integral waste management systems;
- analyze the environmental impact of waste management;
- use the best available techniques of waste management.

Course outline

Theoretical lessons

Waste management terminology and definitions Types of waste. Catalogue of waste. Waste management options: recycling, composting, anaerobic digestion, waste incineration, waste disposal in landfills. **Waste management goals. Key principles of waste management**. **Strategic documents in waste management**: Waste management strategy. National waste management plan. Waste generation prevention program. Waste management plans: regional waste management plan, local waste management plan. Waste management plan in a facility that requires an integrated license. Operation plan of a waste management facility. **Institutional framework of waste management**. **Subjects of waste management. Responsibilities and obligations in a waste management system. Municipal waste management**. **Hazardous waste management**. **Waste movement document**. **Management of special waste flows:** Used batteries and car batteries. Waste oils. Waste tyres. Electric and electronic waste. Fluorescent tubes containing mercury. Waste containing PCBs. Waste containing or contaminated by persistent organic pollutants (POPs waste) and by waste containing asbestos. Vehicle waste. Medical waste. Pharmaceutical waste. Packaging and packaging waste. Animal waste. Agricultural waste. Sludge from devices for municipal wastewater treatment. Construction and demolition waste. **EU and national waste management legislation.**

Practical lessons

Elaboration of waste management plans to reduce the negative environmental impact of waste (municipal, industrial, hazardous, special waste flows).

Literature

[1] Radosavljević Jasmina, Đorđević Amelija (2012). *Deponije i deponovanje komunalnog otpada.* Niš: Univerzitet u Nišu, Fakultet zaštite na radu u Nišu

[2] Radosavljević Jasmina (2009). *Urbana ekologija*. Niš: Univerzitet u Nišu, Fakultet zaštite na radu u Nišu

[3] Tchobanoglous George, Theisen Hilary, Vigil Samuel (1993). *Integrated Solid Waste Management.* New York: McGraw-Hill

[4] Blackman Jr C. William (2016). *Basic hazardous waste management*: Crc Press

Number of active classes (weekly)

Lectures	2	Auditory exercises	2	Other forms of classes	-	RS	-	Other classes	-

Teaching methods Lectures, auditory exercises, discussions, office hours			
Grading (maximum number of points: 100)			
Pre-exam requirements	Points	**Exam**	Points
Activity during lectures	5	Written exam (practical part of the exam)	40
Activity during exercises	5		
Colloquium 1	20		
Colloquium 2	20		
Term paper	10		

Course name: Air Protection		
Course status: Required	**Course code:**	19.OZZS05
ECTS credits: 6		
Requirements: -		

Course aim

Acquisition of knowledge about atmospheric pollution at ground level, air pollution atmospheric dispersion, ambient air quality assessment, and principles and methods of air quality management.

Course outcome

Students' ability to:

- understand ground-level atmospheric pollution processes;
- devise plans and programs for air quality;
- prepare reports and report on ambient air quality condition;
- implement ambient air quality management procedures.

Course outline

Theoretical lessons.

Pollution of the air medium: Concept and definition of air pollution. Global effects of air pollution. Local effects of air pollution. **Pollution sources**: Industry, energy production, transport. **Pollutants**: General, specific, primary, secondary. **Air pollution in the emitter-atmosphere-receptor system:** Emission: emission factors, emission level. Transmission of air pollution. Transport of air pollution through the atmosphere: molecular and turbulent diffusion of air pollution. Immission. **Meteorological elements and phenomena**: Influence of meteorological elements and phenomena on air pollution dispersion. Influence of natural and physical structures. Transformation of air pollution. Deposition of air pollution. **Models of spatial and temporal distribution of air pollution**; Concentration fields. Temporal and spatial variability of air pollution concentration. Isolines of toxicological concentrations. **Regulations and standards for air quality:** Air quality assessment criteria. Qualitative and quantitative assessment of air quality. Air quality index. **Air quality monitoring:** Classification, monitoring principles, monitoring program, air quality monitoring in Serbia.

Practical lessons

Auditory/calculation exercises that follow the theoretical lessons. Calculation exercises include the calculation of circulation zones, determination of chimney/stack height, and calculation of air pollution dispersion from two or more emission sources. Work with software applications for the simulation of air pollution dispersion. Writing, presentation, and defence of a term paper on a topic covered during theoretical lessons – Air protection plan for a chosen city or urban agglomeration.

Literature

[1.] Živković Nenad, Đorđević Amelija (2001). *Zaštita vazduha-teorijske osnove predviđanja zagađenosti vazduha sa primerima rešenih zadataka.* Niš: Univerzitet u Nišu, Fakultet zaštite na radu

[2.] Živković Nenad, Đorđević Amelija (2017). *Monitoring emisije aerozagađenja i kvaliteta ambijentalnog vazduha*. Niš: Univerzitet u Nišu, Fakultet zaštite na radu

[3.] Đuković Jovan (1990). *Zaštita životne okoline-zaštita vazduha*. Sarajevo: Svijetlost, Zavod za izdavanje udžbenika i nastavnih sredstava

[4.] Đuković Jovan, Bojanić Vaso (2000). *Aerozagađenje*. Banja Luka: D.P. Institut zaštite i ekologije

Number of active classes (weekly)									
Lectures	2	Auditory exercises	2	Other forms of classes	0.53	RS	-	Other classes	-
Teaching methods Lectures, auditory exercises, laboratory work, dissections, office hours									
Grading (maximum number of points: 100)									
Pre-exam requirements			Points	**Exam**				Points	
Activity during lectures			5	Written exam (practical part of the exam)				15	
Activity during exercises			5	Oral exam (theoretical part of the exam)				25	
Colloquium 1			15						
Colloquium 2			15						
Term paper			15						
Laboratory work			5						

Course name: Water Protection		
Course status: Required	**Course code:**	19.OZZS06
ECTS credits: 6		
Requirements: -		

Course aim

Acquisition of knowledge about physicochemical and biological composition and character of natural waters, basic water quality parameters, status analysis, pollution sources and protection measures, influencing factors, legislation, and control of water protection system operation.

Course outcome

Students' ability to:

- work independently on control of water quality status;
- plan and implement water protection measures;
- keep a registry of polluters;
- manage surface water quality in drainage basins.

Course outline

Theoretical lessons

Water regime and water balance: Qualitative and quantitative characteristics of water regime in the time-space dimension. **Water quality status**: Influencing parameters, monitoring, quality classes, ecological status. **Water pollution sources**: Driving factors of pressure on natural recipients in terms of wastewater emissions. **Social activities regarding water pollution protection**: Strategic directions in water protection (increase in the number of households connected to the public sanitation system, increase in the quality of properly treated wastewater, prevention of accidental pollutions, etc.). **Typical polluters of surface and groundwater:** Household, industrial, and agricultural wastewater, landfill leachate, mining wastewater, etc., and their impact on quality and aquatic life in natural recipients. **Primary and secondary legislation on water use and protection**: EU directives, Serbian legislation, legislation of surrounding countries. **Registry of water polluters and protective measures**: Qualitative and quantitative characterization of point-source water polluters. Calculation of the necessary degree of purification. **Wastewater treatment**: Unit operations of wastewater treatment with effects, treatment plant schematics – water line, sludge line, and gas line, basic principles of calculation and control of the effects of wastewater treatment plant operation. **Occupational safety and health aspects in water treatment facilities**: Professional risk management in wastewater treatment facilities, sources of hazards, safety measures. **Water protection system management in drainage basins**: Identification of all stakeholder demands in the drainage basin and use of the water information system.

Practical lessons

Calculation exercises and laboratory work pertaining to surface water pollution protection. Application of knowledge acquired during theoretical lessons to the analysis of case studies and in practical laboratory work.

Literature

[1] Ljubisavljević Dejan, Đukić Aleksandar, Babić Branislav (2005). *Prečišćavanje otpadnih voda*. Beograd: Univerzitet u Beogradu, Građevinski fakultet

[2] Veselinović Dragan, Gržetić Ivana, Đermati Šimon, Marković Dragan (1995). *Stanja i procesi u životnoj sredini.* Beograd: Univerzitet u Beogradu, Fakultet za fizičku hemiju

[3] Stojanović Marina, Vasović Dejan (2019). *Zaštita voda (interni materijal za pripremu ispita*. Niš: Univerzitet u Nišu, Fakultet zaštita na radu

[4] Tchobanoglous George, Burton Franklin, Stensel David (2002) Wastewater Engineering: Treatment and Reuse. New York: McGraw-Hill Science/ Engineering/Math

Number of active classes (weekly)

Lectures	2	Auditory exercises	2	Other forms of classes	0.53	RS	-	Other classes	-

Teaching methods

Lectures, auditory and calculation exercises, laboratory work, office hours. Interactive work with students.

Grading (maximum number of points: 100)

Pre-exam requirements	Points	**Exam**	Points
Activity during lectures	5	Written exam (practical part of the exam)	20
Activity during exercises	5	Oral exam (theoretical part of the exam)	20
Colloquium 1	15		
Colloquium 2	15		
Term paper	15		
Laboratory work	5		

Course name: Soil Protection		
Course status: Required	**Course code:**	19.OZZS07
ECTS credits: 6		
Requirements: -		

Course aim

Acquisition of knowledge about morphological, physical, chemical, and biological properties of soil; about soil pollution, pollutant sources and types, behaviour and fate of soil pollutants, impact of pollutants on soil, living organisms, and the environment; and about major categories of soil damage.

Course outcome

Students' ability and skills to:

- understand the basic properties of soil;
- understand the forms of soil pollution;
- understand the forms of soil degradation;
- apply their knowledge to soil remediation;
- apply their knowledge to sustainable soil management.

Course outline

Theoretical lessons

Soil basics: Definition of soil. Soil as a natural resource. Functions of soil. **Genesis and classification of soil:** Abiotic and biotic factors influencing soil formation. Soil horizons. Classification of soil. **Soil properties:** Solid, liquid, and gaseous phase of soil. Physical properties of soil (texture, porosity, colour, bulk density). Chemical properties of soil (mineral and organic substances in soil, reaction of soil, adsorptive properties, redox potential). Biological properties of soil. **Soil pollution**: Definition, types and sources of pollution. Behaviour of pollutants in soil. Entry of pollutants into the food chain. Impact of pollutants on soil, living organisms, and the environment. Soil pollution assessment. **Categories of soil damage**: Degradation. Destruction. Exclusion of soil from production (soil erosion – definition and classification, mechanism and basic factors of water and wind erosion, erosion of soil due to torrential floods, salinization and alkalization of soil, acidification, reduction of organic content, compaction, impact of landfills, landslides, road construction over land, etc.). **Soil monitoring:** Goal of monitoring, planning of monitoring. Selection of monitoring locations and parameters. Data processing and representation; **Soil remediation:** Remediation techniques for polluted soils (physical, chemical, thermal, and biological treatments (bioremediation and phytoremediation). **Sustainable agriculture**: basic concepts, basic principles in organic agriculture, advantages and disadvantages. **Soil protection legislation**.

Practical lessons

Auditory/calculation exercises: Learning about traditional and instrumental methods of sampling and qualitative and quantitative analysis of basic soil quality parameters ($CaCO_3$ content, organic matter content, total nitrogen, available phosphorus and potassium, active and potential acidity – pH); learning about traditional and instrumental methods of sampling and qualitative and quantitative analysis of potential pollutants in the soil and plants (Pb, Ni, Cd, As, Hg, etc.).

Literature

[1] Golubović Tatjana (2011). *Zagađivanje i remedijacija zemljišta-interni materijal za pripremu ispita*.Niš: Univerzitet u Nišu, Fakultet zaštite na radu

[2] Sekulić Petar, Kastori Rudolf, Hadžić Vladimir (2003). *Zaštita zemljišta od degradacije.* Novi Sad: Naučni institut za ratarstvo i povrtarstvo

[3] Kastori Rudolf, Kadar Imre, Sekulić Petar, Bogdanović Darinka, Milošević Nada, Pucarević Mirjana (2006). *Uzorkovanje zemljišta i biljaka nezagađenih i zagađenih staništa*. Novi Sad: Naučni institut za ratarstvo i povrtarstvo
[4] Kadović Ratko, Knežević Milan (2002). *Teški metali u šumskim ekosistemima Srbije*. Beograd: Univerzitet u Beogradu, Šumarski fakultet Beograd
[5] Mirsal A. Ibrahim (2008). *Soil Pollution: Origin, Monitoring and Remediation*, 2nd edition. Berlin: Springer

Number of active classes (weekly)

Lectures	2	Auditory exercises	2	Other forms of classes	-	RS	-	Other classes	-

Teaching methods

Lectures, auditory exercises, calculation exercises, office hours

Grading (maximum number of points: 100)

Pre-exam requirements	Points	**Exam**	Points
Activity during lectures	5	Oral exam (theoretical part of the exam)	40
Activity during exercises	5		
Colloquium 1	20		
Colloquium 2	20		
Term paper	10		

Course name: Theory and Organization of Safety Education		
Course status: Required	**Course code:**	19.OZNR31
ECTS credits: 6		
Requirements:		

Course aim

Introduction to basic theoretical issues of education and the particularities of professional training and organization of educational work for occupational safety and environmental protection, which should precede any work in education, training, qualification, and advancement in this field.

Course outcome

- Ability to organize and implement education for occupational safety and environmental protection;
- Knowledge and skills to create programmes and to conduct and evaluate educational activities;
- Competence to develop plans, strategies, and forms of education and professional training for occupational safety and environmental protection within the context of permanent education.

Course outline

Theoretical lessons

Terminological and theoretical fundamentals of safety education: Terminological definitions. Importance and characteristics of education and information. Education sciences. **Education in the context of sustainable development concept and strategy:** Importance, principles, goals. UN documents, agendas. **Education and professional training as preventive measures in the occupational and environmental safety system**: Human factor in the safety system. Goals and tasks of safety education. Socio-normative aspects / legislation and requirements. Education areas and characteristics of educated population. Theory of occupational and environmental safety education. **Pedagogical-andragogical and psychological bases of safety education and learning:** Definition and functions of learning. Knowledge, skills, and habits. Forms and factors of learning. Learning motivation. Learning theories and methods. Memory, forgetting, transfer. Psychological learning capabilities of adults. Individual traits and styles of adult learning. Professional orientation, information, and selection. **Planning and programming of safety education and training:** Education cycle. Theoretical approaches and didactic understanding of the selection of educational content. Educational plan and programme. Programme of professional safety training (structure, content, principles, programming procedures, Applying the Science of Learning (ASL)). **Organization of safety education:** Organization forms; organizational characteristics of professional safety training. Self-education. **Managing an education group**: Processes, phases, group dynamic. **Methodology of safety education**: Definition and classification of methods. Method of lecture, demonstration, simulation, and others. Selection and verification of methods. Methodological characteristics of professional safety training. **Educational technology in safety education:** Definition, didactic value, importance. Division and classification of teaching tools. ICT in professional safety education and training. Selection and application. **Fundamentals of docimology**: Definition and task of docimology. Methods for testing safety knowledge and competence level. Knowledge tests and weighting. Evaluation of education and training processes. **Teachers and instructors in safety education:** Definition, structure, role, characteristics, andragogical function of teachers/instructors. Planning and preparation of teaching/training (long-term, annual, operative). Preparation of

teachers/instructors for teaching a class.

Practical lessons

Auditory exercises that follow the theoretical lessons, presentation and defence of term papers on topics dealing with current issues and problems of safety education and training. Practical work: Design of analytical-recording lists (of occupational and environmental risks, hazards, and damage), development and design of plan and programs for occupational and environmental safety education and training. Lesson plan preparation. Visits to organizations – "Day of Education" – meeting of theory and practice.

Literature (primary)

[1] Nikolić Vesna (2017). *Teorija i organizacija obrazovanja za zaštitu.* Niš: Univerzitet u Nišu, Fakultet zaštite na radu u Nišu

[2] Anđelković Branislav, Nikolić Vesna (2016). *Safety System and Education for Safety*. Germany: L.Lambert, Academic Publishing, Saarbrücken

Number of active classes (weekly)

Lectures	2	Auditory exercises	2	Other forms of classes	-	RS	-	Other classes	-

Teaching methods

Lectures, conversations and discussions, practical work, office hours

Grading (maximum number of points: 100)

Pre-exam requirements	Points	**Exam**	Points
Activity during lectures	5	Oral exam (theoretical part of the exam)	40
Activity during exercises	5		
Colloquium 1	15		
Colloquium 2	15		
Term paper 1	10		
Term paper 2	10		

Course name: Risk Assessment Methods

Course status: Required | **Course code:** 19.OZNR36

ECTS credits: 6

Requirements: -

Course aim

Acquisition of knowledge about the core methodologies of risk assessment in occupational safety, environmental protection, and fire safety, as well as about the characteristics, advantages, and limitations of the methods used in risk assessment and management.

Course outcome

Students' ability to:

- recognize and identify potential risks in specified systems;
- make an appropriate selection of occupational and environmental risk assessment methods;
- evaluate risks in relation to the analyzed system;
- propose adequate protection systems and preventive and corrective measures for risk reduction.

Course outline

Theoretical lessons

Introduction: Theoretical fundamentals regarding risk. **Risk management**: Approaches and determinants. Basic requirements of ISO 31000. Risk assessment stages. **Methods for occupational and environmental risk assessment**: Classification of methods. Theoretical and practical postulates of the most commonly used risk assessment methods. Energy Analysis - EA. Hazard and Operability Studies -HAZOP. Failure Mode and Effects (and Criticality/Detection) Analysis - FMEA/FMECA/FMEDA. Fault Tree Analysis - FTA. Event Tree Analysis - ETA. Human Reliability Analysis - HRA. Change Analysis - CA. Safety Function Analysis - SFA. Deviation Analysis – DA. Job Safety Analysis - JSA. The Complex Method for Assessment of Overall Hazard of an Accident - CMA. Management Oversight and Risk Tree – MORT. Safety, Health and Environment Management System – SHE-MS. Exergetic Life Cycle Assessment - ELCA. Fire Safety Engineering in Building. Fire and Explosion Index - F&EI. Fire Risk Assessment Method (for) Engineering - FRAME. **Synergy of methods**: Advantages and limitations of the most commonly used occupational and environmental risk assessment methods. **Case studies**: Practical application of the methods.

Practical lessons

Auditory/calculation exercises that follow the theoretical lessons, presentation and defence of a term paper on a topic covered during theoretical lessons.

Literature

[1] Grozdanovic Miroljub, Stojiljkovic Evica (2013). *Risk Assessment Methods*. Monograph. Nis: University of Nis, Faculty of Occupational Safety (in Serbian).

[2] Rausand Marvin (2011). *Risk Assessment: Theory, Methods, and Applications*. New Jersey: John Wiley & Sons Inc.

[3] Janković A. et al. (2009). *Occupational Safety and Health, Book 1.* Kragujevac-Novi Sad: University of Kragujevac, Faculty of Mechanical Engineering (in Serbian).

[4] Sonnemann Guido, Castells Francesc, Schuhmacher Marta (2004). *Integrated Life-Cycle and Risk Assessment for Industrial Processes*. Boca Raton, London, New York, Washington D.C.: CRC Press LLC, Lewis Publishers.

[5] Harms-Ringdahl Lars (2001). *Safety Analysis-Principles and Practice in Occupational Safety*. New York, USA: Taylor & Francis Inc.

Number of active classes (weekly)									
Lectures	2	Auditory exercises	2	Other forms of classes	-	RS	-	Other classes	-
Teaching methods Lectures, auditory (calculation) exercises, and office hours. Interactive work with students. Use of multimedia presentations during lectures.									
Grading (maximum number of points: 100)									
Pre-exam requirements			Points	**Exam**				Points	
Activity during lectures			5	Written exam (practical part of the exam)				20	
Activity during exercises			5	Oral exam (theoretical part of the exam)				20	
Colloquium 1			30						
Colloquium 2			10						
Term paper			10						

Course name: Industrial Ecology		
Course status: Required	**Course code:**	19.OZZS10
ECTS credits: 6		
Requirements: -		

Course aim

Acquisition of skills to ascertain ecological friendliness of industrial products. Gaining knowledge to recognize opportunities for directing by-product flows toward complementary, processes in accordance with the principles of sustainable development. Ability to assess the life cycle of products and to analyse anthropogenic metabolism of a system.

Course outcome

Students would acquire knowledge and skills to:

- assess the opportunities for improvement of industrial products and production systems in terms of environmental protection taking into account the technical and socio-economic constraints;
- consider the overall environmental life cycle impacts of an industrial product;
- apply basic principles and approaches to improve the efficiency of resource use and to close the loop of material flows;
- plan, design and develop eco-industrial symbiosis projects, by-products exchanges, and eco-industrial networks.

Course outline

Theoretical lessons

Industrial ecology and sustainability principles: Fundamentals and historical development of the concept. Industrial growth and development. Environmental consequences of industrial development. Kuznets curve; Internalizing externalities. **IPAT formula:** Model of anthropogenic environmental impact - "master equation"; technological factor, exponential growth and doubling time. Consumerism. **Metabolism of anthropogenic systems:** Mass balance, Homeostasis. Absorption capacity of biosphere. Production system material flow analysis (*MFA*). Sankey's diagrams. Interaction between industrial products and the ecosystem - analogies. **Introduction to life-cycle analysis (LCA) of products and processes:** Development of the concept and methods. Life-cycle phases. LCA implementation stages according to ISO 1404X. **Eco-design (*DfE* concept):** Environmental friendliness criteria for mass consumption industrial products; Efficiency of resource use, dematerialization, design of recyclable structures; Biomimicry. WEEE, RoHS, and ErP directives. Ecolabels and Environmental Product Declarations (EPD); Extended Producer Responsibility (EPR). **Fundamental principles of circular economy**: Urban deposits. Recycling and reuse, biological and technical cycles. **Eco-industrial parks:** Eco-industrial symbiosis. Eco-industrial networks. Exchange of by-products. Closed loops and inter-sectorial networking. **The Kalundborg model:** Development, dynamics, and nature of interconnections, integration of complementary industrial sectors and public utility services. Strategic planning of waste-free anthropogenic systems.

Practical lessons

Elaboration of relevant topics pertaining to industrial development. Discussions on concepts, methods, and development trends in the economy and environmental protection through interactive critical thinking exercises. Numerical exercises (exponential growth and doubling time, material flow analysis); presentation of case studies and examples of good engineering practice; presentation of relevant software tools; defence of term papers.

Literature

[1.] Glišović Srđan (2017). *Održivo projektovanje i životna sredina*. (Sustainable Design and the Environment, *in Serbian*) Niš: Univerzitet u Nišu, Fakultet zaštite na radu u Nišu

[2.] Graedel E. Thomas, Allenby R. Braden (2010). *Industrial Ecology and Sustainable Engineering*, Pearson

[3.] Hodolič Janko, Vukelić Đorđe, Hadžistević Miodrag, Budak Igor, Badida Miroslav, Šooš Lubomir, Kosec Borut, Bosak Martin (2011). *Reciklaža i reciklažne tehnologije*. (Recycling and recycling technologies, *in Serbian*) Novi Sad: Univerzitet u Novom Sadu, Fakultet tehničkih nauka

[4.] *Osnove cirkularne ekonomije* (2016). Privredna komora Srbije, GIZ, Beograd

[5.] Petrović Branislav, Dakić Ratko (2002). *Osnove teorije sistema*. Novi Sad: Univerzitet u Novom Sadu

Number of active classes (weekly)

Lectures	2	Auditory exercises	2	Other forms of classes	-	RS	-	Other classes	-

Teaching methods

Lectures, exercises, discussions, presentation of term papers, presentation of software packages, consultations

Grading (maximum number of points: 100)

Pre-exam requirements	Points	**Exam**	Points
Activity during lectures	5	Written exam (practical part of the exam)	25
Activity during exercises	5	Oral exam (theoretical part of the exam)	15
Colloquium 1	20		
Colloquium 2	20		
Term paper	10		

Course name: Spatial Planning and Environmental Protection

Course status: Required | **Course code:** 19.OZZS11

ECTS credits: 6

Requirements: -

Course aim

Acquisition of theoretical knowledge about spatial planning and organization, spatial structures and resources, factors influencing and enabling spatial planning, and environmental protection measures implemented during spatial planning and organization.

Course outcome

Students' ability to:

- apply their knowledge in the field of environmental engineering during spatial planning and organization;
- create strategic impact assessments.

Course outline

Theoretical lessons

Spatial planning – definition, subject matter, aims, tasks, and principles of spatial planning. **Types of spatial planning**: Spatial Plan of the Republic of Serbia, regional spatial plan, spatial plan of a local self-government unit, spatial plan for special-purpose areas, general urban plan, general regulation plan, detailed regulation plan. **Natural and man-made spatial features and their effect on spatial planning and protective measures**. **Spatial organization and implementation of protective measures during construction of**: industrial zones, residential areas, transportation infrastructure, and urban water and sanitation systems. **Spatial structuring and implementation of protective measures during construction of sanitary landfills.** Structures, works, and flood protection measures for settlements. Fire safety measures in spatial and urban plans. Strategic impact assessment.

Practical lessons

Elaboration of current topics concerning spatial and urban planning through the writing and defence of term papers.

Literature

[1] Radosavljević Jasmina (2010). *Prostorno planiranje i zaštitaživotne sredine*. Niš: Univerzitet u Nišu, Fakultet zaštite na radu u Nišu

[2] Radosavljević Jasmina (2009). *Urbana ekologija*. Niš: Univerzitet u Nišu, Fakultet zaštite na radu u Nišu

[3] Tošković Dobrivoje (2007). *Uvod u prostorno i urbanističko planiranje*. Beograd: GrosKnjiga

Number of active classes (weekly)

Lectures	2	Auditory exercises	2	Other forms of classes	-	RS	-	Other classes	-

Teaching methods

Lectures, auditory exercises, discussions, office hours

Grading (maximum number of points: 100)

Pre-exam requirements	Points	**Exam**	Points
Activity during lectures	5	Written exam (practical part of the exam)	40
Activity during exercises	5		
Colloquium 1	15		
Colloquium 2	15		
Term paper	20		

Course name: Internship		
Course status: Required	**Course code:**	19.OZZS14
ECTS credits: 3		
Requirements: Internship is completed in the seventh semester.		

Course aim

Becoming familiar with the operational process in the company (institution) in which the internship is done, with its goals, and with its organizational units. Meeting the team and learning about the project students join as part of the internship, selected according to the study programme they chose. Understanding of the work process in the company (institution), the operative processes, and occupational risks. Participation in design projects, document creation, or quality control, in keeping with the work process and the possibilities of the work environment.

Course outcome

Students' ability to:

- improve their abilities to join the workforce after their studies;
- acquire a clear insight into the possibility of practically applying the acquired theoretical, scientific, and professional knowledge and skills covered in the study programme;
- solve specific issues in the scientific field Environmental and Occupational Engineering within the selected company or institution;
- understand the role of a bachelor with honours in occupational safety engineering, environmental engineering, and disaster and fire safety engineering within the organizational structure of a company or institution;
- develop responsibility, professional work approach, and team communication skills;
- use experiences of other professionals employed at the institution of the internship in order to expand their practical knowledge and increase their motivation.

Course outline

Internship content is fully compliant with internship aims and is created specifically for each student, according to the activity of the company (institution) where the internship is done and according to the demands of the profession for which a student is educated. Students become familiar with the structure of the company (institution) and its operation objectives, adapt their own involvement to the study programme they chose, and regularly fulfil their work duties, which correspond to the duties of regular employees of the company (institution). Students provide an account of their involvement during the internship and critically reflect upon their experience and the knowledge and skills they acquired during the internship.

As a rule, students choose a company (institution) from the government, private, or public sector for their internship. The internship may be done in institutions within Serbia that have a written agreement with the Faculty of Occupational Safety or that give consent for accepting student interns.

At a student's proposal, the vice dean for education approves the internship at a chosen company (institution) and then issues the written internship order form. Based on the internship logbook, which needs to record at least 90 internship classes, and the certificate of internship signed by the authorized person and stamped with the company (institution) seal, confirming that the internship has been completed, the student is awarded 3 ECTS after the internship defence before the professors appointed for the defence by the Teaching and Scientific Council of the faculty.

Number of active classes (weekly)									
Lectures	-	Auditory exercises	-	Other forms of classes		RS	-	Other classes	6
Teaching methods Consultations during the internship and creation of the internship logbook.									
Grading (maximum number of points: 100) Completed internship and creation and defence of the internship logbook are graded using the descriptors “defended” or “not defended”.									

Course name: Ecological Risk		
Course status: Required	**Course code:**	19.OZZS15
ECTS credits: 6		
Requirements: -		

Course aim

Aim – Acquisition of knowledge about characteristics and sources of hazards causing environmental degradation (habitats, species, populations, communities, and the ecosystem), which are implemented in ecological risk. **Objective** – Acquisition of skills to perform qualitative and quantitative assessment of ecological risks and hazards.

Course outcome

Students' ability to:

- identify and predict physicochemical environmental hazards and describe ecological risks and hazards;
- analyze cause-and-effect environmental phenomena for the purpose of ecological risk management.

Course outline

Theoretical lessons

Definition of risk: Risk and risk event. Risk types and classification. Definition of ecological risk. Ecological risk analysis – hazard, vulnerability (threat), damage, risk formation. **Ecological risk assessment:** Goals and function of ecological risk assessment. Ecological risk assessment stages – hazard formulation (identification of stressors, identification of potential ecosystem risk, ecological effects, target selection in hazard assessment, comprehensive data model). Risk analysis (contamination source and its characteristics), exposure pathways (identification of possible sources and pathways of exposure, exposure intensity). Risk characterization (risk evaluation, risk description). **Assessment of cumulative environmental risk**. **Ecological risk management**. **Health risk assessment:** Hazard identification, exposure assessment, dose-response assessment, health risk characterization, health risk management. **Specific forms of ecological risk – ecological risk caused by natural threats:** earthquakes, tsunamis, floods, droughts, landslides volcanoes, heavy weather. **Ecological risk caused by anthropogenic threats:** Chemical accidents. Assessment of technogenic risk and environmental risk. Calculation and classification of hazard index for each individual facility. Assessment of severe technogenic accidents. Assessment of the severity of the effects of a severe accident on the environment and the population. Calculation of different scopes of thereat or damage. Greenhouse effect and climate change. Ozone layer damage. Acid rain.

Practical lessons

Quantification of environmental risk and/or health risk caused by specific accidents (receptor characterization – habitat, species, population, community, and ecosystem; exposure assessment; hazard assessment; risk characterization)

Project assignment: Quantification of a specific analyzed ecological risk in real or allotted time.

Literature

[1] Đorđević Amelija, Stevanović Vladica (2019). *Ekološki rizik*. Niš: Univerzitet u Nišu, Fakultet zaštite na radu u Nišu

[2] National Center for Environmental Assessment Office of Research and Development (2007). *Exposure Factors Handbook.* US EPA

[3] *Ecological Risk Assessment* (2003). UNEP/IPCS Training Module No. 3

<table>
<tr><td colspan="10">[4] A Framework for Ecological Risk Assessment Technical Appendices (1997). Canadian Council of Ministers of the Environment</td></tr>
<tr><td colspan="10">Number of active classes (weekly)</td></tr>
<tr><td>Lectures</td><td>3</td><td>Auditory exercises</td><td>2</td><td>Other forms of classes</td><td>-</td><td>RS</td><td>-</td><td>Other classes</td><td>-</td></tr>
<tr><td colspan="10">Teaching methods
Lectures, auditory exercises, term paper</td></tr>
<tr><td colspan="10">Grading (maximum number of points: 100)</td></tr>
<tr><td colspan="4">Pre-exam requirements</td><td>Points</td><td colspan="3">Exam</td><td colspan="2">Points</td></tr>
<tr><td colspan="4">Activity during lectures</td><td>5</td><td colspan="3">Oral exam (theoretical part of the exam)</td><td colspan="2">40</td></tr>
<tr><td colspan="4">Activity during exercises</td><td>5</td><td colspan="3"></td><td colspan="2"></td></tr>
<tr><td colspan="4">Colloquium 1</td><td>20</td><td colspan="3"></td><td colspan="2"></td></tr>
<tr><td colspan="4">Colloquium 2</td><td>20</td><td colspan="3"></td><td colspan="2"></td></tr>
<tr><td colspan="4">Term paper</td><td>10</td><td colspan="3"></td><td colspan="2"></td></tr>
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Course name: Environmental Noise		
Course status: Required	**Course code:**	19.OZZS16
ECTS credits: 6		
Requirements: -		

Course aim

Acquisition of theoretical and practical knowledge and ability: to identify and understand the principles and occurrences of environmental noise; to apply the appropriate theoretical framework, software tools, and experimental techniques for identification and characterization of noise sources and noise calculation and evaluation; and to identify and understand the harmful effects of noise.

Course outcome

Students' acquisition of skills and ability to:

- understand and apply physical laws of sound wave generation and propagation;
- calculate indoor and outdoor noise levels;
- calculate energy and physiological quantities;
- calculate the acoustic properties of rooms;
- measure, analyze, and evaluate the state of noise levels, sound power of sound sources, and acoustic properties of rooms using current standards and regulations.

Course outline

Theoretical lessons

Sound and sound waves: Concept of sound. Definitions of sound and noise. Generation of sound. Propagation of sound. Characteristic sound wave quantities. Reflection, diffraction, diffusion, and refraction of sound waves. **Acoustic energy quantities:** Sound energy and sound energy density. Sound intensity. Sound power. **Point sources of sound:** Model of a sound point source. Sound sources with non-directional and directional radiation. Spatial angle of radiation. Combined effect of independent sound sources (simple and complex sound). Sound source next to an obstacle. **Perception of sound:** Function and characteristics of the organ of hearing. Outer, middle, and inner ear – characteristics and function. Sound transmission. Frequency decomposition of a sound signal along the basilar membrane. Frequency and dynamic range of hearing: Frequency range. Dynamic range of hearing. **Objective quantities for describing sound intensity:** Reason for using sound levels. Definition of sound levels. Decibel scale. Change of sound level. Resulting level of complex sound. Sound level of a specific sound source. Rules for noise level measurement. **Subjective quantities for describing sound intensity:** Subjective sound intensity. Loudness. **Frequency weighting curves:** A and C curves. **Subjective energy quantities:** Equivalent noise level. Level of exposure to sound. **Noise propagation in enclosed areas:** Enclosed space. Large enclosed space modelling. Statistical model: absorption coefficient, basic hypotheses, process of sound field generation, statistical model equations. Reverberation time. Spaces with a high sound absorption coefficient. Sound transmission coefficient and isolation capacity of the partition. Room sound isolation. **Fundamental principles of noise management:** Fundamental principles and phases of noise management. Directive on environmental noise assessment and management. Serbian legislation on noise. Basic, auxiliary, and supplementary environmental noise indicators. Rating noise level. Limit values of environmental noise indicators: open space and accommodation areas. **Effects of noise on humans.** Auditory and extra-auditory effects of noise. **Fundamental principles of noise protection.** Protection at the source, along transmission pathways, and at reception point. **Noise measurement:** Types of noise (temporal character of noise, frequency character of noise, scope of noise sources. Measurement chain: Condenser

microphones; Noise signal detector; Band frequency analysis (1/1 and 1/3 octave filters). Methods of frequency analysis. Measurement chain calibration. Measurement quantities. **Environmental noise measurement:** Standards and regulations. Selection of measurement locations. Measurement procedure. **Measurement of sound power of sound sources:** Standards. Measurement procedure. **Reverberation time measurement:** Standards. Measurement procedure. **Measurement of partition isolation capacity:** Standards. Measurement procedure.

Practical lessons

Calculation exercises during which practical problems are solved thematically follow the theoretical lessons and thus contribute to a better understanding of the course materials and complement students' knowledge. Calculation of different acoustic quantities under specific operating conditions of noise sources: sound pressure, sound power, sound intensity, sound level, subjective sound intensity, loudness, equivalent noise level, sound exposure level, rating noise level, noise indicators, sound absorption coefficient, absorbing surface of the room, room reverberation time, indoor sound level, room sound isolation.

Laboratory work: Measurement of environmental noise. Measurement of sound power of sound sources. Measurement of reverberation time. Measurement of partition isolation capacity.

Literature

[1.] Praščević Momir, Cvetković Dragan, Mihajlov Darko (2019). *Buka u životnoj sredini* – drugo dopunjeno i izmenjeno izdanje (elektronsko izdanje), Niš: Univerzitet u Nišu, Fakultet zaštite na radu u Nišu

[2.] Praščević Momir, Cvetković Dragan (2005). *Buka u životnoj sredini,* Niš: Univerzitet u Nišu, Fakultet zaštite na radu u Nišu

Number of active classes (weekly)

Lectures	3	Auditory exercises	2	Other forms of classes	0.53	RS	-	Other classes	-

Teaching methods

Lectures, auditory (calculation) exercises, laboratory work (8 weeks), office hours. Interactive work with students. Use of multimedia presentations during lectures.

Grading (maximum number of points: 100)

Pre-exam requirements	Points	**Exam**	Points
Activity during lectures	5	Written exam (practical part of the exam)	20
Activity during exercises	5	Oral exam (theoretical part of the exam)	20
Colloquium 1	20		
Colloquium 2	20		
Laboratory work	10		

Course name: Diploma Thesis – Research		
Course status: Required	**Course code:**	19.ZZS19A
ECTS credits: 5		
Requirements: Enrolment in the eighth semester		

Course aim

Use of basic, theoretic-methodological, scientific-professional, and professional-applicative knowledge and methods to solve specific problems. Individual research study, which can have a practical, investigative, or theoretical-methodological character. Acquisition of required skills through solving complex issues and problems and identification of opportunities to practically apply the previously acquired knowledge.

Course outcome

Students' ability to:

- independently formulate and analyze problems and critically examine potential solutions;
- independently apply previously acquired knowledge from the various fields they studied in order to examine the structure of a given research problem, as well as to apply systems analysis in order to draw conclusions about the possible ways of solving the given research problem;
- independently use literature, thus expanding their knowledge by studying different methods and publications that deal with similar issues;
- analyze and identify problems within a given topic and propose the ways to solve them;
- consider the place and role of engineers in their chosen field;
- develop team spirit and team work;
- apply acquired engineering knowledge and skills to solve problems in practice;
- stay up to date with and utilize new developments in their profession.

Course outline

According to their preferences and affinity, students choose their research study area, specifically the course within which they will conduct their research associated with their previously approved topic of the diploma thesis. The mentor defines the research study task according to the requirements, complexity, and structure of a specific research.

Students study the problem and its structure and complexity, and study professional literature, including scientific and professional publications dealing with the given or similar topic; after analyzing the literature, they draw conclusions about potential problem solutions. By examining the literature, students learn about the methods used to solve similar problems and about the previous engineering practice regarding problem solutions. The research study also requires students to stay up to date with primary knowledge, to organize and conduct experiments and numerical simulations, to process data statistically, and to write a research paper from the narrow scientific field of their research study topic.

The mentor evaluates the research study based on a student's defence of the research paper and approves the writing of the diploma thesis, which includes the results of the research study.

Literature

Number of active classes (weekly)

Lectures	-	Auditory exercises	-	Other forms of classes		RS	4	Other classes	

Teaching methods			
With the mentor's aid, students independently solve a given problem and research the subject matter, after which they write a research paper.			
Grading (maximum number of points: 100)			
Pre-exam requirements	Points	**Exam**	Points
Research paper – writing	50	Research paper – defence	50

Course name: Diploma Thesis – Writing and Defence		
Course status: Required	**Course code:**	19.ZZS19B
ECTS credits: 3		
Requirements: Completion of exams for all courses in the study programme		

Course aim

Combination of the theoretical background and the research study to solve a specific problem, for the purpose of examining the structure and performing a systems analysis of the problem in order to draw conclusions about the possible ways of solving it. Gaining experience of presenting the results of the research study in written form and orally, during the diploma thesis defence.

Course outcome

Students' ability to:

- independently present the results of their research by writing their thesis and presenting it orally at the thesis defence;
- write the thesis according to a required form;
- clearly and satisfactorily elaborate on their proposed solutions to the given problem through an oral presentation of the thesis and response to the subsequent questions.

Course outline

By combining the research study and the theoretical background of the given problem, students write their diploma thesis, which has to contain the following elements: abstract with key words in Serbian, table of contents, introduction, research text body (formulation of the research problem and subject matter, presentation of the current state of the given research field, theoretical or practical portion of the research, results and discussion), conclusion, list of cited literature (minimum of ten references, of which at least six have to be academic and professional publications and at least one has to be written in a foreign language), and appendices.

The committee for diploma thesis evaluation and defence evaluates the written thesis and approves the public oral defence of the diploma thesis, which is organized before a committee of three members, one of whom is the mentor. During the oral defence, the candidate presents the results of their research and then answers the questions from committee members, thus demonstrating the ability to orally present a project.

Literature

Number of active classes (weekly)

Lectures	-	Auditory exercises	-	Other forms of classes		RS		Other classes	2

Teaching methods

With the mentor's aid, students write their diploma thesis and prepare for the oral defence. Students consult with the mentor and other members of the committee for diploma thesis evaluation and defence.

Grading (maximum number of points: 100)

Pre-exam requirements	Points	**Exam**	Points
Written thesis	30	Thesis defence	70

LIST OF ELECTIVE COURSES

1. Occupational and Environmental Quality Indicators
2. Fire and Explosions
3. Emergencies
4. Energy Efficiency in Building Design and Construction
5. Environmental Chemistry
6. Toxicology
7. Instrumental Methods of Pollutant Analysis
8. Public Utility Systems and the Environment
9. Safety Application of Information Technology
10. Integrated Management Systems
11. Environmental Impact Assessment
12. Sustainable Development
13. Integrated Pollution Prevention and Control
14. Industrial Waste Treatment
15. Natural Resource Management
16. Health Protection

Course name: Occupational and Environmental Quality Indicators

Course status: Elective | **Course code:** 19.OZNR20

ECTS credits: 6

Requirements: -

Course aim

Acquisition of basic knowledge about the concept and classification of indicators and about the elements of a report on the state of the work and natural environment.

Course outcome

Students' acquisition of skills and ability to:

- understand the methodology of the National List of Indicators;
- analyze and create environmental quality indicators;
- analyze and create work environment quality indicators;
- analyze and create fire indicators;
- create sets of indicators depending on the identified problems.

Course outline

Theoretical lessons

Definition of indicators. Classification of indicators. Social and economic indicators. **Indicators of the state of the work environment:** Definition and classification. Number of occupational injuries and number of fatal occupational injuries. Index of occupational injury frequency. Index of occupational injury severity. Disability index. **Indicators of the state of fires and explosions:** Definition and classification. Number of fires in terms of the population number. Number of fatalities per fire. Chain base index. **Indicators of the state of the natural environment:** Definition and classification. Indicators of pollution sources. Impact indicators. Air and climate change indicators. Water indicators. Soil indicators. Natural and biological diversity indicators. Energy indicators. Agricultural indicators. Transport indicators. Tourism indicators. Noise indicators. Radiation indicators. Urbanization indicators. Indicators of international and national legislation. Indicators of subjects of the environmental protection system and of environmental elements' quality. **Indicators of sustainable development.** Indicators of sustainable energy development. Indicators of sustainable industrial development. **Procedure of indicator selection.** Ranking of indicators. Sets of sustainable development indicators.

Practical lessons

Exercises follow the theoretical lessons, with problem solving and defence of term papers.

Literature

[1] Malenović Nikolić Jelena (2020). *Indikatori kvaliteta radne i životne sredine (interni materijal za pripremu ispita)*. Niš: Univerzitet u Nišu, Fakultet zaštite na radu u Nišu

[2] Malenović Nikolić Jelena (2019). *Indikatori kvaliteta radne i životne sredine (praktikum)*. Niš: Univerzitet u Nišu, Fakultet zaštite na radu u Nišu

[3] Agencija za zaštitu životne sredine (2007). *Indikatori životne sredine u Republici Srbiji*. Beograd: Ministarstvo životne sredine

[4] *Nacionalna lista indikatora životne sredine* (2011). Ministarstvo životne sredine, rudarstva i prostornog planiranja, „Službeni Glasnik" Republike Srbije br. 37/2011

Number of active classes (weekly)

Lectures	2	Auditory exercises	2	Other forms of classes	-	RS	-	Other classes	-

Teaching methods

Lectures, auditory exercises, office hours

Grading (maximum number of points: 100)			
Pre-exam requirements	Points	**Exam**	Points
Activity during lectures	5	Written exam (practical part of the exam)	30
Activity during exercises	5	Oral exam (theoretical part of the exam)	10
Colloquium 1	15		
Colloquium 2	15		
Term paper	20		

Course name: Fire and Explosions

Course status: Elective | **Course code:** 19.OZNR21

ECTS credits: 6

Requirements: -

Course aim

Acquisition of theoretical knowledge about fire and explosions as physicochemical phenomena of mass and heat transfer under specific conditions of their development.

Course outcome

Students' acquisition of skills and ability to:

- identify fire and explosion hazards;
- assess the risk of fire and explosions;
- take preventive, technical, and organizational fire safety measures.

Course outline

Theoretical lessons

Combustion processes: Definition, retrospective of combustion process studies. Physical processes during combustion. Chemical aspects of combustion. Stoichiometric equations of combustion. Types of combustion (homogeneous and heterogeneous, kinetic and diffuse, stationary and nonstationary, deflagrating, explosive, and detonating). **Flammable materials**: Combustion of flammable materials (gases, liquids, and solids). Physical properties of flammable materials (flash point, minimum ignition temperature, fire point, autoignition temperature, heat of combustion, flammability/explosive limits). Classification of flammable materials. **Oxidizing agent**: Role of oxidizing agent in the process of combustion. Types of oxidizing agents. **Source of ignition**: Definition and types of ignition sources (open flame and sparks, glowing materials, heated surfaces, mechanical sparks, electric energy, static electricity, natural phenomena). **Autoignition**: Mechanism of autoignition. Types of autoignition. **Fire as a process of uncontrolled combustion**: Definition. Fire onset conditions (necessary and additional). Fire triangle and fire tetrahedron. **Fire parameters**: Fire load (mass and heat). Hotspot. Blaze. Fire heat. Fire temperature. Fire products. Effects of smoke on humans. **Fire stages and zones**: Flashover and backdraft. Combustion zone. Heat impact zone (heat transfer modes, heat balance). Smoke production zone. **Mass transfer of gaseous fractions**: Neutral plane. Mass balance of fire. **Classification of fires**: Classification according to point of origin. Classification according to the nature of material stability during combustion, stage of development, heat release rate, regime of combustion, scope, and size. **Explosions**: Definition. Mechanism of explosive combustion (theory of deflagration and detonation, chemical reaction zone, detonation initiation, detonation wave, fireball explosion – BLEVE). Explosive thermal decomposition equations. Oxygen balance. **Types of explosions**: Physical, nuclear, and chemical explosions. **Chemical explosions**: Conditions necessary for explosions. Types of materials that can cause an explosion. Explosions of explosive materials. Explosions of flammable gases, vapours, and liquids. Explosions of organic and metal dusts. **Parameters of explosions:** Heat, temperature, and pressure of explosions (pressure growth rate and maximum explosion pressure). Products of explosions. **Impact of explosions on humans. Blast zones**: Characteristics and classification of blast zones.

Practical lessons

Calculation exercises that follow the theoretical lessons: Solving calculation problems of combustion of flammable gases, vapours, and dust mixed with air. Calculation of products of deflagration and explosive combustion. Calculation of explosion temperature and pressure.

Literature

[1.] Pešić Dušica (2019). Požari i eksplozije – interni materijal za pripremu ispita. Niš: Fakultet zaštite na radu u Nišu

[2.] James G. Quintiere (2016). Principles of Fire Behavior. Boca Raton: CRC Press

[3.] Jovanov Radovan (2015). Eksplozije u industrijskim objektima. Beograd/Zemun: AGM knjiga.
[4.] Pešić Dušica, Zigar Darko (2013). Požari i eksplozije (zbirka zadataka). Niš: Univerzitet u Nišu, Fakultet zaštite na radu u Nišu

Number of active classes (weekly)

Lectures	2	Auditory exercises	2	Other forms of classes	-	RS	-	Other classes	-

Teaching methods

Lectures (oral exposition, multimedia presentations, discussions), auditory/calculation exercises, office hours

Grading (maximum number of points: 100)

Pre-exam requirements	Points	**Exam**	Points
Activity during lectures	5	Written exam (practical part of the exam)	10
Activity during exercises	5	Oral exam (theoretical part of the exam)	30
Colloquium 1	20		
Colloquium 2	30		

Course name: Emergencies

Course status: Elective | **Course code:** 19.OZOP04

ECTS credits: 6

Requirements: -

Course aim

Acquisition of knowledge about the causes, origins, development, and effects of emergencies and the institutional framework for emergency management.

Course outcome

Students' ability and skills to:

- identify emergencies;
- assess the threat of emergencies;
- manage risks of emergencies;
- define, plan, and design emergency prevention and response measures.

Course outline

Theoretical lessons

Emergencies – basic terminology, classification, characteristics, development phases. Natural emergencies – earthquakes, floods, landslides, cyclones, natural fires, infectious diseases (characteristics and effects). Technogenic emergencies – classification of technological systems according to hazard level. Social emergencies – social unrest, terrorist activities, diversions. **Emergencies in Serbia**. Types, origin, and frequency. Institutional framework for emergency management. Legislation regarding emergencies. Methodology for emergency threat assessment. **Floods**. Definition, origin, influencing factors, types, societal and environmental impacts, selection of flood control measures. **Earthquakes.** Definition, characteristics, origin, measurements, classification, protective measures. Seismic risk. **Landslides.** Definition, endogenous and exogenous factors, formation of landslides, classification, protective measures, and recovery. **Droughts.** Definition, influencing factors, classification of droughts, protective measures. Index methods for drought intensity assessment. **Technical and technological accidents**. Causes and phases of technical and technological accidents. Accidents in chemical industry, petroleum industry, transport, etc. Impact on the physical and work environment and on material resources. Proactive approach. **Forest fires**. Origin, influencing factors, classification, suppression tactics, protective measures. **Other emergencies** (ice floe, windstorms, hail, snow). Emergency predictions and early warnings. Consequences of other emergencies. **Engineering and technical protective measures during emergencies**. Protective measures during earthquakes, floods, landslides, droughts, technical and technological accidents, forest fires, and other emergencies. emergency management cycle based on previous experiences.

Practical lessons

Exercises that successively follow the theoretical lessons, which involve the analysis of concrete examples of emergencies. Students conduct their own research, resulting in the writing, presentation, and defence of a term paper on an assigned topic concerning emergencies.

Literature

[1] Milošević Lidija (2018). Vanredne situacije, Izvodi sa predavanja, Niš: Univezitet u Nišu, Fakultet zaštite na radu u Nišu.

[2] Birkmann (2004). Measuring Vulnerability to Natural Hazards: Towards Disaster Resilient Societies. UNU Press.

[3] Coppola R. Damon (2015). Introduction to International Disaster Management. Elsevier.

[4] Laban, M. et al. (2020). Glossary of terms in disaster risk management and fire safety / Rečnik pojmova iz upravljanja rizikom od katastrofalnih događaja i požara. Novi Sad, Fakultet tehničkih nauka.

Number of active classes (weekly)

Lectures	2	Auditory exercises	2	Other forms of classes	-	RS	-	Other classes	-

Teaching methods

Lectures, auditory exercises, office hours. Interactive work with students.

Grading (maximum number of points: 100)

Pre-exam requirements	Points	**Exam**	Points
Activity during lectures	5	Oral exam (theoretical part of the exam)	40
Activity during exercises	5		
Colloquium	25		
Term paper	25		

Course name: Energy Efficiency in Building Design and Construction		
Course status: Elective	**Course code:**	19.OZZS03
ECTS credits: 6		
Requirements: -		

Course aim

Acquisition of knowledge pertaining to energy efficiency in building design and construction and measures to increase energy efficiency and reduce energy consumption in the residential sector.

Course outcome

Students' ability to:

- estimate energy consumption in building design and construction;
- use measures for solving the issues of efficient energy use in building design and construction;
- use software tools to analyze the energy efficiency of buildings.

Course outline

Theoretical lessons

General requirements for achieving energy efficiency of buildings: Climatic, general planning, urban planning, architectural, construction, safety, energy, mechanical engineering, legal, and economic requirements). Energy consumption in buildings. **Determination of energy performance of buildings**: Determination of annual energy required for heating and cooling, total annual final and primary energy, and annual SO_2 emission. **Requirements and measures for achieving comfort in buildings:** Thermal, indoor air, visual, and acoustic comfort. Energy efficiency of buildings. Goals and measures for achieving energy efficiency in building design and construction. **Thermal envelope of buildings and its optimization:** Optimization of surface area and geometry, thermal isolation of solid segments, thermal isolation of glass segments, passive use of solar radiation, active use of solar radiation, heat flow reduction, reduction of incoming radiation, thermal mass and ventilation, envelope with photovoltaic panels, solar technology and building envelope, solar technology and architecture. Structural assembly of buildings. Use of renewable energy sources in building design and construction. Green and passive buildings. Examples of good practice in Serbia and abroad. Energy efficiency study. EU and national legislation pertaining to energy efficiency.

Practical lessons

Calculation exercises: Calculation of energy balance of buildings

Literature

[1] Radosavljević Jasmina, Pavlović Tomislav, Lambić Miroslav (2010). *Solarna energetika i održivi razvoj*. Beograd: Građevinska knjiga

[2] Gvozdenac Dušan, Gvozdenac Urošević Branka, Morvaj Zoran (2012), *Energetska efikasnost – industrija i zgradarstvo,* Novi Sad: Fakultet tehničkih nauka.

[3] Miloradović Nenad (2011). *Termički aspekti gradnje kuća – istorijat i perspektive*, Beograd: Građevinska knjiga

[4] Lambić Miroslav, Tolmač Dragiša, Tasić Ivan, Stojićević Dragan, Mijić Vlado (2009). *Energetska efikasnost, upravljanje, racionalna potrošnja, efikasnost,* Zrenjanin: Srbija Solar

[5] *Pravilnik o energetskoj efikasnosti zgrada* (Sl. glasnik RS, br. 61/2011)

Number of active classes (weekly)									
Lectures	2	Auditory exercises	2	Other forms of classes	-	RS	-	Other classes	-

Teaching methods
Lectures, auditory exercises, discussions, and office hours

Grading (maximum number of points: 100)			
Pre-exam requirements	Points	**Exam**	Points
Activity during lectures	5	Written exam (practical part of the exam)	40
Activity during exercises	5		
Colloquium 1	15		
Colloquium 2	15		
Term paper	20		

Course name: Environmental Chemistry		
Course status: Elective	**Course code:**	19.OZZS04
ECTS credits: 6		
Requirements: -		

Course aim

Acquisition of basic theoretical and practical knowledge about physicochemical, chemical, and biochemical processes in the air, water, and soil, for the purpose of environmental state monitoring and environmental protection.

Course outcome

Students' ability and skills to:

- understand the naturally-occurring chemical processes in the environment;
- understand the impact of human activities on chemical processes in the environment;
- understand and predict the sources and behaviours of pollutants in the environment;
- understand the impact of pollutants on living organisms;
- propose measures for pollution prevention and environmental protection.

Course outline

Theoretical lessons

Introduction to environmental chemistry: Role of chemistry in environmental protection. Origin of environmental spheres. **Atmosphere:** Structure and basic chemical characteristics of the Earth's atmosphere. Natural and anthropogenic constituents of tropospheric air. **Hydrosphere:** Distribution and forms of water in environmental spheres. Natural waters – origin of basic chemical substances. Natural and anthropogenic substances influencing the quality of natural waters. **Lithosphere:** Structure and basic characteristics. Physical and chemical properties of soil. Natural and anthropogenic substances influencing soil quality. **Cycles of elements and compounds through environmental spheres (biogeochemical cycles):** Cycle of carbon, oxygen, nitrogen, sulphur, phosphorus, and water. **Influence of physicochemical and chemical properties of substances on their behaviour in the environment:** Transport. Deposition. Transformation. Biotransformation. Degradation. **Behaviour of selected pollutant classes in the environment:** Metals in the environment. Petroleum and petroleum products. Pesticides. Polymers. Polycyclic aromatic hydrocarbons. Polychlorinated biphenyls. Dioxins. Furans.

Practical lessons

Prediction of behaviour of chemical substances in the environment according to their chemical structure and physicochemical and chemical properties. Application of the knowledge acquired during theoretical lessons in laboratory practice (sampling and analysis of materials from the environment). Application of the knowledge acquired during theoretical lessons in the analysis of case studies. Discussion via term papers about current topics pertaining to the presence of pollutants in the environment.

Literature

[1] Stojanović Marina, Miltojević Ana (2019), *Osnovi hemije životne sredine – interni materijal za pripremu ispita.* Niš: Univerzitet u Nišu, Fakultet zaštite na radu u Nišu

[2] Veselinović Dragan, Gržetić Ivan, Đarmati Šimon, Marković Dragan (1995). *Stanja i procesi u životnoj sredini,* Beograd: Univerzitet u Beogradu, Fakultet za fizičku hemiju

[3] Đarmati Šimon, Veselinović Dragan, Gržetić Ivan, Marković Dragan (2007). *Životna sredina i njena zaštita (knjiga 1- Životna sredina)*. Beograd: Fakultet za za primenjenu ekologiju Futura

[4] Pfendt Petar (2009). *Hemija životne sredine.* Beograd: Zavod za udžbenike
[5] Conell Des (2005). *Basic Concepts of Environmental Chemistry.* Boca Raton, FL: CRC Press

Number of active classes (weekly)

Lectures	2	Auditory exercises	2	Other forms of classes	-	RS	-	Other classes	-

Teaching methods
Lectures, auditory exercises, office hours, term paper

Grading (maximum number of points: 100)

Pre-exam requirements	Points	**Exam**	Points
Activity during lectures	5	Oral exam (theoretical part of the exam)	40
Activity during exercises	5		
Colloquium 1	20		
Colloquium 2	20		
Term paper	10		

Course name: Toxicology		
Course status: Elective	**Course code:**	19.OZNR24
ECTS credits: 6		
Requirements: -		

Course aim

Acquisition of basic knowledge about toxic substances, mechanisms of their generation and action, and the effects on living organisms, all for the purpose of assessing health risk sand hazards and proposing preventive and protective measures.

Course outcome

Students' acquisition of skills and ability to:

- understand the fundamental principles of toxicology;
- understand the effects of toxic substances on living organisms;
- qualitatively and quantitatively analyze toxic substances;
- assess risk from exposure to toxic substances;
- propose and implement preventive and protective measures.

Course outline

Theoretical lessons

Introduction to toxicology: Definition, subject matter, tasks, and branches of toxicology. Fundamental principles in toxicology. Mechanism of toxic effect. Toxicological parameters. **Toxic substances:** Definition, classification, and properties of toxic substances. **Exposure to toxic substances:** Exposure pathways. Toxicokinetics (absorption, transport, distribution, deposition, excretion, and biotransformation of toxic substances). **Toxicodynamics:** Mechanisms of toxic substance effects. Dose-response relationship. Combined effect of toxic substances. **Nonspecific toxicity:** Chemical carcinogenesis, genotoxicity, mutagenesis. **Specific toxicity for a target organ:** Effect of toxic substances on specific organs and organ systems. **Toxic effects of selected groups of toxic substances:** Toxic effects of metals, pesticides, vapours and solvents, and biotoxins. **Methods of analysis of toxic substances:** Methods of qualitative and quantitative analysis of toxic substances. **Toxicity tests:** *In vivo, in vitro, in silico* toxicity tests. Epidemiological studies. **Protective measures during exposure to toxic substances:** Technical and technological, hygienic and medical, and organizational and human resource measures of protection.

Practical lessons

Auditory/calculation exercises: Determination of toxicological parameters (no-observed-effect level/concentration (NOEL/NOEC). Median toxic dose/concentration (TD_{50}/TC_{50}). Median lethal dose/concentration (LD_{50}/LC_{50})). Establishment of connections between substance structure and toxicity. Calculation of content of occupational toxic substances. Learning about classical and instrumental methods used for sampling and qualitative and quantitative analysis of occupational toxic substances. Writing and presentation of term papers focusing on a selected group of toxic substances.

Literature

[1] Popović Danilo (2008). *Toksikologija – interni materijal za pripremu ispita.* Niš: Univerzitet u Nišu, Fakultet zaštite na radu u Nišu

[2] Jokanović Milan (2001). *Toksikologija*. Beograd: Elit Medika

[3] Vitorović Slavoljub, Milošević Milenko (2002). *Osnovi toksikologije sa elementima ekotoksikologije*. Beograd: Vizartis

[4] Klaassen Curtis (2013). *Casarett & Doull's Toxicology: The Basic Science of Poisons*. New York, NY: McGraw-Hill Professional

[5] Harbison Raymond, Bourgeois Marie, Johnson Giffe (2015). *Hamilton and Hardy's Industrial Toxicology*. Hoboken, NJ: John Wiley & Sons, Inc.

Number of active classes (weekly)									
Lectures	2	Auditory exercises	2	Other forms of classes	-	RS	-	Other classes	-
Teaching methods Lectures, auditory/calculation exercises, office hours.									
Grading (maximum number of points: 100)									
Pre-exam requirements			Points	**Exam**				Points	
Activity during lectures			5	Oral exam (theoretical part of the exam)				40	
Activity during exercises			5						
Colloquium 1			20						
Colloquium 2			20						
Term paper			10						

Course name: Instrumental Methods of Pollutant Analysis		
Course status: Elective	**Course code:**	19.OZZS08
ECTS credits: 6		
Requirements: -		

Course aim

Acquisition of basic knowledge about instrumental methods of environmental pollutant analysis. Introduction to sampling methods and to preparation and analysis of samples from different environmental media for the purpose of determining the presence and content of pollutants.

Course outcome

Students' ability and skills to:

- work independently and/or in a team on qualitative and quantitative analysis of environmental pollutants;
- understand the basic principles of instrumental methods of analysis and operating principles of instruments;
- plan experiments and select appropriate methods for sampling, sample preparation, and analysis;
- conduct experiments on, sample, and qualitatively and quantitatively analyze environmental pollutants, as well as process and interpret the obtained results.

Course outline

Theoretical lessons

Environmental data acquisition: Sampling basics and environmental sample analyses. **Introduction to analytical environmental chemistry:** Most common environmental pollutants. Expression of quantitative composition of mixtures. Basic measurement terminology (measurement methods, precision, accuracy, reliability, *recovery*, detection limit, quantification limit, standard calibration line). Methods of expressing analytical data. Basics of statistical data processing. **Experiment planning:** Experiment in practice. Approach to experimental studies. **Errors during the acquisition of data on environmental pollutants**: Types of errors. Sampling errors. Errors of analysis. **Sampling:** Sampling methods. Transport and storage of sampled materials. **Preparation of samples for analysis:** Extraction (extraction in a separatory funnel, continuous extraction, *Soxhlet* extraction, solid-phase extraction, ultrasonic extraction, pressurized extraction, supercritical fluid extraction). Chromatography methods (thin-layer chromatography (TLC), gas chromatography (GC), liquid chromatography (LC), high-performance liquid chromatography (HPLC), ion exchange chromatography) and derivatization methods. **Methods of analysis:** Traditional and instrumental methods of analysis. **Traditional methods of analysis:** Gravimetry. Volumetry; **Instrumental methods of analysis:** Thermogravimetry (TGA). Electrochemical methods of analysis (potentiometry, conductometry, voltammetry). Spectrochemical methods of analysis (ultraviolet-visible spectroscopy (UV-VIS) and infrared (IR) spectroscopy). Atomic spectroscopy (atomic absorption spectroscopy (AAS), inductively coupled plasma (ICP), atomic *X-ray* fluorescence). Fundamentals of nuclear magnetic resonance (NMR), overview of coupled methods (ICP-MS, ICP-OES, GC-MS, GC-FID, LC-MS). **Quality assurance and control (QA/QC) during the analysis of environmental pollutants:** Overview of standard methodologies. Selection of an appropriate standard method for sampling and analysis.

Practical lessons

Auditory/calculation exercises: Calculation of environmental pollutants' content (in water, air, and soil). Expression of measurement results (accurate number, rounding rules, significant figures, measurement errors, standard lines, graph drawing, statistical

data processing). Learning about the instruments used for the analysis of environmental pollutants.

Laboratory work: Sampling of water, air, and soil in the field and preparation of samples for the analysis. Determination of *pH* value, electrical conductivity, dissolved oxygen concentration, and turbidity of water. Spectrophotometric determination of concentrations of ammonia, nitrites, and nitrates in water. Determination of *pH* value and electrical conductivity of soil. Spectrophotometric determination of SO_2 and nitrogen oxides. Determination of hydrocarbon concentrations in the air using the GC-MS method.

Literature

[1] Mišović Jelica, Ast Teodor (1989). *Instrumentalne metode hemijske analize*. Beograd: Tehnološko-metalurški fakultet u Beogradu

[2] Milosavljević Slobodan (1997). *Strukturne instrumentalne metode*. Beograd: Hemijski fakultet u Beogradu

[3] Marjanović Nikola (2001). *Instrumentalne metode analize, I/1. Metode razdvajanja*. Banja Luka: Tehnološki fakultet u Banja Luci

[4] Chunlong Zhang (2007). *Fundamentals of Environmental Sampling and Analysis*. Hoboken, Nj: John Wiley & Sons, Inc.

[5] Dunnivant Frank (2004). *Environmental Laboratory Exercises for Instrumental Analysis and Environmental Chemistry*. Hoboken, W: John Wiley & Sons, Inc.

Number of active classes (weekly)

Lectures	2	Auditory exercises	2	Other forms of classes	0.20	RS	-	Other classes	-

Teaching methods

Lectures, auditory/calculation exercises (10 weeks), laboratory work (5 weeks), office hours, term paper

Grading (maximum number of points: 100)

Pre-exam requirements	Points	**Exam**	Points
Activity during lectures	5	Written exam (practical part of the exam)	20
Activity during exercises	5	Oral exam (theoretical part of the exam)	20
Colloquium 1	15		
Colloquium 2	15		
Term paper	10		
Laboratory work	10		

Course name: Public Utility Systems and the Environment		
Course status: Elective	**Course code:**	19.OZZS09
ECTS credits: 6		
Requirements: -		

Course aim

Acquisition of knowledge and skills pertaining to public utility activities, elements of a public utility system, interaction with the environment, models of functional integration of public utility activities into a single public utility system for the purpose of improving urban environmental quality.

Course outcome

Students' ability to:

- design and organize urban public utility systems;
- manage processes in the public utility system;
- analyze the interactions between the public utility system and the urban environment;
- define and implement environmental protection measures within public utilities.

Course outline

Theoretical lessons

Classification and basic characteristics of public utilities: Historical development. Public importance of public utilities. Definitions, terminology. **Organization and development of public utilities**: Institutional and legislative framework of public utilities. Competences of the state, regions, and local self-governments. **Organizational structure of the public utility system**: Models of providing public utility services. Public utility companies and other entrepreneurs. Identification of processes and subjects in the urban public utility system. Integration of public utilities into a single urban public utility system. **Calculation of technical capacities for initiating and providing public utility services**: Analysis of technical capacities of existing public utility companies. Procedure for creating new public utility companies in terms of minimal technical requirements for the initiation and provision of public utility services. **Models of transformation and reorganization of public utility companies**: Experiences of developed countries. Experiences of transition countries. **Interactions between the public utility system and the environment**: Elements and criteria for the environmental impact assessment of the public utility system and public utilities (water and sanitation, municipal waste management, district heating, public transportation, public green spaces, zoohygiene, chimney sweeping, etc.). **Public utility system management and quality management systems**: Place and role of the management system for quality, environment, and occupational safety and health within public utilities. SWOT analysis of the public utility sector in Serbia**. Study of urban environmental capacity and the public utility system**: Elements and criteria for the development of urban public utilities: demographic trends, water consumption trend, percentage of green areas, municipal waste generation trend, surfaces available for public utilities.

Practical lessons

Analysis of the environmental impact of different public utility activities (drinking water supply, sanitation and treatment of atmospheric and wastewater, municipal waste management, chimney sweeping, zoohygiene, cleaning of public spaces, maintenance of public green spaces, etc.). Organizational chart of the public utility system.

Literature

[1] Vasović Dejan (2019). Komunalni sistemi i životna sredina (*interni materijal za pripremu ispita)*. Niš: Univerzitet u Nišu, Fakultet zaštite na radu u Nišu
[2] *Vodič za politiku cena komunalnih usluga u opštinama i gradovima Srbije* (2017). Beograd: Stalna konferencija gradova i opština
[3] Liveable cities: the benefits of urban environmental planning – a cities alliance study on good practices and useful tools (2007). Washington: World Bank
[4] Integrating the environment in urban planning and management (2013). Nairobi: United Nations Environmental Programme

Number of active classes (weekly)

Lectures	2	Auditory exercises	2	Other forms of classes	-	RS	-	Other classes	-

Teaching methods

Lectures, auditory (calculation) exercises, office hours. Interactive work with students.

Grading (maximum number of points: 100)

Pre-exam requirements	Points	**Exam**	Points
Activity during lectures	5	Oral exam (theoretical part of the exam)	40
Activity during exercises	5		
Colloquium 1	15		
Colloquium 2	15		
Term paper	20		

Course name: Safety Application of Information Technology

Course status: Elective	**Course code:**	19.OZNR37

ECTS credits: 5

Requirements: -

Course aim

Acquisition of knowledge about IT application in the domain of safety.

Course outcome

Students' acquisition of skills and ability to:

- apply IT to solve specific problems of safety system management;
- use information and communication technology (ICT) to monitor new developments in this field, to acquire new knowledge, and become proficient in team work and collaborative decision making.

Course outline

Theoretical lessons

Information: Definition, amount, relevance, types. **Technologies of electronic components and operation of modules.** Technology of semiconductor integrated circuits, flip-flop circuits, memory components, execution of memory devices, ROM and RAM memories. Technology of magnetic media memories, magnetic tapes, magnetic discs, Flash memory. **Fundamentals of telecommunication data transfer**, analogue and digital signals, communication system – model, channel, encoding, bit rate, modulation. **Technology of telecommunication data transfer**, data buses, types of transfer materials, types of cables, optical transfer, wireless transfer. **Processes over data.** Real-time acquisition, storage, and processing of information from the physical and work environment. **Algorithmization.** Problem-solving on the algorithm level. **Basic elements of computer networking.** Local computer networks. Measurement tools and methods. Data processing methods. Modelling and simulation. **Information systems.** Use of information networks and WEB technologies in safety engineering. Use of IT in environmental management. **Practical use of general-purpose application software** (Excel, Access), the Internet, and specialized problem-solving application software (bases, expert systems, risk assessment systems) in the field of occupational safety and environmental protection.

Practical lessons

Auditory exercises and computer laboratory exercises. Acquisition of practical knowledge about data and database manipulation software. Students are tested via practical work on PCs at the computer laboratory.

Literature

[1] Seen A. James (2007). *Informaciona tehnologija*: *Principi, praksa, mogućnost*. Beograd: Kompjuter biblioteka

[2] Pleskonjić Dragan, Maček Nemanja, Đorđević Borislav, Carić Marko (2007). *Sigurnost računarskih mreža*. Beograd: Mikro knjiga

[3] Krstić Dejan, Blagojević Milan, Janaćković Goran (2019). *Računarska tehnika - osnovi organizacije i primene personalnih računara*. Niš: Univerzitet u Nišu, Fakultet zaštite na radu u Nišu

Number of active classes (weekly)

Lectures	2	Auditory exercises	2	Other forms of classes	0.27	RS	-	Other classes	-

Teaching methods

Lectures, calculation exercises (8 weeks) and computer laboratory exercises (7 weeks); multimedia and video presentations

Grading (maximum number of points: 100)			
Activity during lectures	5	Written exam (practical part of the exam)	10
Activity during exercises	5	Oral exam (theoretical part of the exam)	30
Colloquium 1	25		
Colloquium 2	25		

Course name: Integrated Management Systems		
Course status: Elective	**Course code:**	19.OZNR38
ECTS credits: 5		
Requirements: -		

Course aim

Acquisition of knowledge and skills related to quality management systems, environmental protection, occupational safety and health, and other management systems in an organization. Learning to develop and apply principles and models of management system integration and to integrate environmental quality and occupational safety and health into the integrated management system of the organization.

Course outcome

Students' ability to:

- understand, interpret, and meet the requirements of different management systems;
- create documentation for different management systems;
- integrate multiple management systems into a single integrated management system;
- improve the efficiency and effectiveness of an organization's activities;
- implement procedures of internal and external audits.

Course outline

Theoretical lessons

Systems of organizational business system management: basic characteristics, terms and definitions in a quality management system, terminology. **Standards and standardization in management systems**: historical development of management systems, standards and standardization, authorized institutions. **Quality management principles:** process model of management systems, systems approach, leadership, employee participation. **Steps in the development and implementation of quality management systems**: PDCA cycle, revised PDCA cycle. **Requirements for quality management systems according to SRPS ISO 9001**: quality management system principles, organizational, management system, and documentation requirements. **Requirements for environmental management systems according to SRPS ISO 14001**: environmental management system principles, terms and definitions in an environmental management system, documentation requirements. **Requirements for occupational safety and health management systems according to SRPS ISO 45001**: principles of occupational safety and health management systems, organizational and documentation requirements for management systems, professional risk analysis and management in occupational safety and health management system. **Requirements for environmental management systems according to EMAS III**: origin and development of EMAS standard, EMAS standard implementation steps, verification. **Requirements for fire safety management systems according to standards ISO 23932, ISO 16732 and other related standards**: organizational, management system, and documentation requirements. **Other standards and systems**: standards for laboratory accreditation, information security, corporate social responsibility, risk management, production of safe food. **Creation of an integrated management system**: integration models, phases and steps, principles and rules of management system integration according to BSI PAS 99 specification.

Practical lessons

Use of system standards and establishment of a system for quality management, environmental management, occupational safety and health management, and fire safety management (case studies of implementation across various sectors or in specific

organizations). Examples and creation of documents for a management system. Management system integration project. Internal and external audits.

Literature

[1] Vasović Dejan (2020). Interni materijal za pripremu ispita. Niš: Univezitet u Nišu, Fakultet zaštite na radu u Nišu.
[2] Guideline Integrated Management System (IMS). (2018). Stuttgart: AEB SE – Services.
[3] Raković Radoslav (2014). Integrisani sistem menadžmenta. Beograd: Građevinska knjiga.
[4] Bugdol Marek, Jedynak Piotr (2015). Integrated Management Systems. Cham, Switzerland: Springer International Publishing.
[5] Kounis Leo - Editor (2018). Quality Management Systems. London: IntechOpen Limited

Number of active classes (weekly)

Lectures	2	Auditory exercises	2	Other forms of classes		RS	-	Other classes	-

Teaching methods

Lectures, auditory (calculation) exercises, office hours. Interactive work with students.

Grading (maximum number of points: 100)

Pre-exam requirements	Points	**Exam**	Points
Activity during lectures	5	Oral exam (theoretical part of the exam)	40
Activity during exercises	5		
Colloquium 1	15		
Colloquium 2	15		
Term paper	20		

Course name: Environmental Impact Assessment

Course status: Elective | **Course code:** 19.OZZS12

ECTS credits: 5

Requirements: -

Course aim

Acquisition of knowledge about the procedures of environmental impact assessment for projects and about performing the assessment.

Course outcome

Students' ability to:

- implement environmental impact assessment procedures and create strategic impact assessment studies;
- assess the environmental impact of projects and create environmental impact assessment studies;
- verify an environmental impact assessment study;
- monitor environmental protection measures defined by the impact assessment process.

Course outline

***Theoretical lessons**:*

Definition of environmental impact assessment: General principles of environmental impact assessment and their connection to the principles of sustainable development. Subject of environmental impact assessment, participation in the impact assessment process. Elements of the impact assessment process. **Initial phases of the impact assessment process:** Prediction and evaluation of environmental impact significance, impact assessment methods, selection of methods. **Impact analysis and impact prediction:** Methods of impact analysis. Representation of impact characteristics. Consultations with the public and public participation in the impact assessment process, consideration of alternatives. **Documentation of impact assessment and quality control**: Impact assessment and adoption of solutions. Impact assessment of the current state. Post-project phases of impact assessment. **Strategic impact assessment**: Subject of strategic assessment. Strategic planning. Document on the strategic environmental impact assessment. Procedure of strategic impact assessment implementation.

Practical lessons

Auditory exercises that follow the theoretical lessons, including the preparation of students to write a term paper on a topic covered during the theoretical lessons, specifically with regard to environmental impact assessment (for a selected project) and its verification. Practical lessons also include exercises where students are involved in public participation during the public presentation of the environmental impact assessment study at the Environmental Protection Administration of the City of Niš.

Literature

[1.] Živković Nenad (2007). *Procena uticaja na životnu sredinu*. Niš: Univerzitet u Nišu, Fakultet zaštite na radu u Nišu

[2.] Bogdanović Slavko, Nojković Svetlana, Vesić Aleksandar (2005). *Vodič kroz postupak procene uticaja na životnu sredinu*, Beograd: Regionalni centar za životnu sredinu

[3.] Stojanović Božidar, Maričić Tamara (2008). *Metodologija strateške procene uticaja prostornog plana rudarsko-energetskog kompleksa na životnu sredinu*. Beograd: Institut za arhitekturu i urbanizam Srbije

Number of active classes (weekly)

Lectures	30	Auditory exercises	30	Other forms of classes	-	RS	-	Other classes	-

Teaching methods Lectures, auditory (calculation) exercises, office hours. Interactive work with students.			
Grading (maximum number of points: 100)			
Pre-exam requirements	Points	**Exam**	Points
Activity during lectures	5	Oral exam (theoretical part of the exam)	40
Activity during exercises	5		
Colloquium 1	15		
Colloquium 2	15		
Term paper	20		

Course name: Sustainable Development

Course status: Elective	**Course code:**	19.OZZS13

ECTS credits: 5

Requirements: -

Course aim

Acquisition of knowledge about the goals, principles, and components of sustainable development and about national and local sustainable development strategies.

Course outcome

Students' ability to:

- understand and apply the paradigm of sustainable development in their further specialization;
- analyze the deficiencies of developing concepts in specific sectors and to produce sustainable solutions in environmental development and protection at the micro and macro level;
- integrate the three pillars of sustainable development (economy, social development, and environmental protection) by using a systems approach.

Course outline

Theoretical lessons

Definition, foundation, and critical analysis of sustainable development: Definition of development. Development as a doctrine. Economic growth and development. Decades of development. **Sustainable development:** Definition and historical roots. Economic dimension. Social dimension. Environmental dimension. **Planning of sustainable development:** National strategies of sustainable development. Local strategies of sustainable development. Serbian national strategy of sustainable development. Urbani sustainable development. Indicators of sustainable development.

Practical lessons

Introductory seminar: "The Unpleasant Truth – Global Causes of Unsustainability of Development"; Debates ("Ecological Costs of Chinese Growth"; "Moving beyond GDP"; "Problems with GDP as a Measure of Economic Growth"; "Prioritizing development" – Bjorn Lomborg; "Visions of a Sustainable World" – Paul Raskin; "Sustainability for All" – Jonathon Porritt); Seminar: "Sustainable development and climate change"; Case analyses: Bogota, Colombia; Karlstad, Sweden.

Literature

[1.] Milutinović Slobodan (2012). *Politike održivog razvoja*. Niš: Univerzitet u Nišu, Fakultet zaštite na radu

[2.] Đukić Petar (2011). *Održivi razvoj - utopija ili šansa za Srbiju*. Beograd: Univerzitet u Beogradu, Tehnološko-metalurški fakultet

[3.] Pešić Radmilo (2002). *Ekonomija prirodnih resursa i životne sredine*. Beograd: Univerzitet u Beogradu, Poljoprivredni fakultet

Number of active classes (weekly)

Lectures	2	Auditory exercises	2	Other forms of classes	-	RS	-	Other classes	-

Teaching methods

Teacher presentations, seminars, debates, case analyses

Grading (maximum number of points: 100)

Pre-exam requirements	Points	**Exam**	Points
Activity during lectures	10	Oral exam (theoretical part of the exam)	40
Activity during exercises	10		
Colloquium 1	20		
Colloquium 2	20		

Course name: Integrated Pollution Prevention and Control		
Course status: Elective	**Course code:**	19.OZZS17
ECTS credits: 5		
Requirements: -		

Course aim

Acquisition of knowledge about procedures of implementing integrated environmental pollution prevention and control, about preparing the documentation for obtaining the integrated permit, and about environmental protection requirements stated in the integrated permit.

Course outcome

Students' ability to:

- independently apply procedures of integrated pollution prevention and control;
- create documentation for the integrated permit (application, review, reissue);
- evaluate the efficiency and effectiveness of the process of integrated pollution prevention and control;
- evaluate the equipment and devices according to the environmental protection requirements stated in the integrated permit.

Course outline

Theoretical lessons

Integrated pollution prevention and control (IPPC): definition, origin, and development of the Directive, purviews. **Reasons for adopting the IPPC Directive**: activities of the European Commission and the International Organization for Standardization in the domain of industrial emission management, Pareto principle. **Goals of the IPPC Directive**: establishment of mechanisms for reduction and control of industrial emissions according to standards for environmental quality. **Integrated pollution prevention and control in EU countries**: experiences with the implementation of the Directive in different countries and areas of application, capacity building mechanisms of authorized bodies, ecological performance. **Industrial Emissions Directive (IED)**: modification and integration of integrated pollution prevention and control with other relevant directives (titanium dioxide directive, directive on high power furnaces, etc.). **Integrated pollution prevention and control in Serbia**: transposition of Directive requirements into the national legislation, law, and other secondary acts. Identification and characterization of operators in Serbia. **Process of issuing the integrated permit**: dynamics of issuing integrated permits, creation of the application form for the issuing of integrated permit, compliance with the environmental protection requirements stated in the integrated permit, periodic reviews of the issued integrated permit, issuing of integrated permit to current and new operators. **Access to information and public participation in the implementation of the IPPC directive**: mechanisms for public participation in the issuing of integrated permit in public interest sectors. **Best available techniques (BAT)**: Sevilla process, general assumptions of the BAT principle, application of BAT in specific cases, BAT recommendations for reducing industrial emissions, BREF documents, place and role of BREF documents in the system of integrated pollution prevention and control, techno-economic analysis of the best available techniques. **Effects of IPPC directive implementation**: environmental performance, economic aspects, capacities of authorized bodies.

Practical lessons

Implementation of IPPC Directive (case studies of application in various sectors and by specific operators)

Literature

[1] Vasović Dejan (2019). *Integrisana prevencija i kontrola zagađenja (interni materijal za pripremu ispita)*. Niš: Univerzitet u Nišu, Fakultet zaštite na radu
[2] *BREF referentni dokumenti o najboljim dostupnim tehnikama* (2019). Beograd: Agencija za zaštitu životne sredine Republike Srbije
[3] *Integrated Pollution Prevention and Control - Practical Guide* (2005). London: Department for Environment, Food and Rural Affairs
[4] *Integrisano sprečavanje i kontrola zagađivanja životne sredine u sektoru intenzivnog uzgoja živine i svinja - priručnik za izradu zahteva za integrisanu dozvolu* (2017). Beograd: Univerziteta u Beogradu, Tehnološko-metalurški fakultet

Number of active classes (weekly)

Lectures	2	Auditory exercises	2	Other forms of classes	-	RS	-	Other classes	-

Teaching methods

Lectures, auditory (calculation) exercises, office hours. Interactive work with students.

Grading (maximum number of points: 100)

Pre-exam requirements	Points	**Exam**	Points
Activity during lectures	5	Written exam (practical part of the exam)	20
Activity during exercises	5	Oral exam (theoretical part of the exam)	20
Colloquium 1	15		
Colloquium 2	15		
Term paper	20		

Course name: Industrial Waste Treatment		
Course status: Elective	**Course code:**	19.OZNR44
ECTS credits: 5		
Requirements: -		

Course aim

Acquisition of knowledge about industrial waste generation, waste characteristics, waste management methods in production systems, and industrial waste treatment systems and devices.

Course outcome

Students' ability to:

- describe and categorize industrial waste;
- select methods, procedures, and techniques of waste management at the generation site;
- select systems and devices for the treatment of industrial waste gases and wastewater;
- monitor and control the efficiency of systems and devices;
- select methods for treatment and final disposal of industrial waste.

Course outline

***Theoretical lessons**:*

Production processes as waste generators: Definition and classification of waste. Categorization and characterization of waste form production processes. Regulations and standards for waste management. **Ecological dimensions of industrial waste management:** Definition, classification. Minimization of gaseous and liquid waste. Purification, phase separation, phase transformation. **Waste gas treatment**: gravity separation, inertial separation, centrifugal separation, filtration, electrostatic separation, separation in scrubbers, sorption gas phase separation methods: absorption, adsorption, desorption. **Wastewater treatment methods:** mechanical methods, biochemical methods, chemical methods, sludge treatment. Devices and facilities for the treatment of wastewater from specific industries. **Industrial solid waste management methods:** documentation accompanying waste pathway, industrial waste handling, waste separation, temporary storage, reuse of waste, physical and mechanical methods of waste treatment, thermal methods, biothermal methods, waste composting.

Practical lessons

Auditory/calculation exercises that follow the theoretical lessons, presentation and defence of term papers on a topic covered during theoretical lessons. Calculation exercises include the calculation of material balance of waste gas treatment devices, determination of their efficiency, their sizing (gravity settling chambers, inertial impactors, cyclones, electrostatic precipitators and filters), as well as settling chambers for wastewater treatment. Practical lessons also include visits to wastewater treatment plants and to facilities with waste gas treatment devices within the selected industrial complex.

Literature

[1] Živković Nenad (2020). *Prečišćavanje industrijskih otpadnih materija*. Niš: Univerzitet u Nišu, Fakultet zaštite na radu u Nišu
[2] Živković Nenad (2001). *Visokoefektivni filtri u ekotehnici čistih soba*. Niš: Univerzitet u Nišu Fakultet zaštite na radu u Nišu
[3] Bogner Martin (2001). *Tehnika prečišćavanja*. Beograd: Univerzitet u Beogradu, Mašinski fakultet
[4] Ilić Marina, Miletić Saša (1998). *Osnovi upravljanja čvrstim otpadom*. Beograd: Institut za ispitivanje materijala

Number of active classes (weekly)									
Lectures	2	Auditory exercises	2	Other forms of classes		RS	-	Other classes	-

Teaching methods
Lectures, auditory (calculation) exercises, office hours. Interactive work with students.

Grading (maximum number of points: 100)			
Pre-exam requirements	Points	**Exam**	Points
Activity during lectures	5	Oral exam (theoretical part of the exam)	40
Activity during exercises	5		
Colloquium 1	15		
Colloquium 2	15		
Term paper	20		

Course name: Natural Resource Management		
Course status: Elective	**Course code:**	19.OZZS18
ECTS credits: 5		
Requirements: -		

Course aim

Acquisition of necessary theoretical and practical knowledge about natural resources and their sustainable management, which allow students, as future professionals, to become involved in the creation of practical policies regarding resource management in general and, specifically, natural resource management.

Course outcome

Students' ability to:

- understand the complexity of global issues pertaining to natural resources and their management, international cooperation, and the role of sustainable natural resource management in sustainable development;
- identify and describe multiple aspects of sustainable natural resource management;
- analyze key drivers of natural resource management policy and the most important stressors to which natural systems are exposed;
- assess and apply methods for balancing competitive interests in natural resource management;
- synthesize and apply theories and methods from multiple disciplines dealing with natural resource management;
- analyze the ethical aspects and social impacts of natural resource management.

Course outline

Theoretical lessons

Definition and classification of natural resources: Resources: meaning of the term, historical development of theories on resources, classification of resources. Natural resources – definition and classification. Parameters for classification of natural resources. Potential of natural resources. Valuation of natural resources. Efficiency of natural resource use.

Natural resource management: Concept of management in environmental protection. Natural resource management. Approaches to natural resource management – exploitation approach; utilitarian approach; conservation approach; ecological approach. *Decoupling*. Integrated natural resource management). **Tenets and principles of natural resource management. Economic foundations of natural resource management. Strategies and concepts in resource management:** Carrying capacity. Ecological footprint. Environmental space. Dematerialization. Factor 4 and Factor 10. Entropy and exergy. Valuation of externalities. Ecological accounting; cost and benefit analysis. **Management of protected areas, biodiversity, geodiversity, and landscape diversity.**

Practical lessons

Showing of the film "The Dark Side of Green Energy" and discussion; Showing of the film "Home" and discussion; Case analyses: Open pits in Ústí nad Labem Region in the North-western Czech Republic; "Boškov Most" hydropower plant – Mavrovo National Park, North Macedonia; Paldiski liquefied natural gas terminal in a protected natural area, Estonia; Construction of small hydropower plants in protected areas, Serbia; Multilateral negotiations about the Scheldt River estuary; Economic valuation of forest resources and services, Tunisia; Analysis of the "Stara Planina" Natural Park Management Plan for the 2020-2029 Period.

Literature

[1] Milutinović Slobodan (2020). *Upravljanje prirodnim resursima*. Niš: Fakultet zaštite na radu (textbook in preparation)
[2] Harris M. Jonathan (2009). *Ekonomija životne sredine i prirodnih resursa*. Beograd: Data status.
[3] Pešić Radmilo (2002). *Ekonomija prirodnih resursa i životne sredine*. Beograd: Univerzitet u Beogradu, Poljoprivredni fakultet

Number of active classes (weekly)

Lectures	2	Auditory exercises	2	Other forms of classes	-	RS	-	Other classes	-

Teaching methods

Teacher presentations, seminars, debates, case analyses

Grading (maximum number of points: 100)

Pre-exam requirements	Points	**Exam**	Points
Activity during lectures	10	Oral exam (theoretical part of the exam)	40
Activity during exercises	10		
Colloquium 1	20		
Colloquium 2	20		

Course name: Health Protection		
Course status: Elective	**Course code:**	19.OZNR46
ECTS credits: 5		
Requirements: -		

Course aim

Acquisition of knowledge about the effect of professional harmful factors and workloads on workers' health and work capacity and about harmful environmental agents affecting human health and quality of life, and assessment of their significance in the overall burden of disease among the population.

Course outcome

Students' knowledge and capability of:

- performing health risk assessment;
- taking measures to prevent professional diseases and occupational injuries;
- determining the health effects of specific environmental contaminants;
- evaluating work ability during professional orientation in the event of fires, floods, earthquakes, and other emergencies.

Course outline

Theoretical lessons

Occupational safety and health. Occupational safety and health protection. Continuous improvement of occupational safety and health. Hygienic safety measures. Medical safety measures. **Work hygiene.** Interaction between occupational and environmental factors. Role of the occupational medicine service in the creation of the Risk Assessment Act. Sanitary and hygiene organization in the work and physical environment. Nutrition and work. **Professional pathology.** Professional diseases, work-related diseases, and occupational injuries. Pre-employment and periodic medical examinations. Professional trauma. Determination of special requirements and loads at work. Professional rehabilitation. **Physical harms and their impact on employee health.** Professional diseases and biological effects of high and low temperature, increased and decreased humidity, air flow, higher and lower barometric pressure, lighting, noise, vibration, and ionizing and nonionizing radiation. **Chemical harms and their impact on employee health.** Professional diseases caused by chemical harms (diseases of the nose and paranasal cavities, diseases of the pharynx, diseases of the larynx, skin diseases). **Biological harms and their impact on employee health.** Professional diseases caused by biological harms (zoonoses, anthrax, brucellosis, erysipeloid, tularaemia, leptospirosis, and others). **Environmental protection and health.** Impact of water, soil, air, food, noise, vibration, and electromagnetic radiation on human health. Biomonitoring and assessment of health risk and health outcome (disease contraction, hospitalization, and mortality). Preventive measures for reducing environmental issues and their impact ono human health. **Fire safety and health.** Professional carbon monoxide poisoning of fire and rescue unit members, first aid, and safety measures. Evaluation of work ability during professional orientation, professional selection, and pre-employment, periodic, and unscheduled medical examinations for work in the event of fires, floods, earthquakes, and other emergencies.

Practical lessons

Auditory exercises that successively follow the theoretical lessons and involve the analysis of practical examples concerning health protection. Writing, presentation, and defence of term papers on a health protection topic.

Literature

[1] Aranđelović Mirjana, Jovanović Jovica (2009). *Medicina rada*. Niš: Univerzitet u Nišu, Medicinski fakultet

<table>
<tr><td colspan="10">[2] Blagojević Ljiljana (2012). Životna sredina i zdravlje. Niš: Univerzitet u Nišu, Fakultet zaštite na radu u Nišu</td></tr>
<tr><td colspan="10">Number of active classes (weekly)</td></tr>
<tr><td>Lectures</td><td>2</td><td>Auditory exercises</td><td>2</td><td>Other forms of classes</td><td>-</td><td>RS</td><td>-</td><td>Other classes</td><td>-</td></tr>
<tr><td colspan="10">Teaching methods
Lectures, auditory exercises, office hours. Interactive work with students.</td></tr>
<tr><td colspan="10">Grading (maximum number of points: 100)</td></tr>
<tr><td colspan="4">Pre-exam requirements</td><td>Points</td><td colspan="3">Exam</td><td colspan="2">Points</td></tr>
<tr><td colspan="4">Activity during lectures</td><td>5</td><td colspan="3">Oral exam (theoretical part of the exam)</td><td colspan="2">40</td></tr>
<tr><td colspan="4">Activity during exercises</td><td>5</td><td colspan="3"></td><td colspan="2"></td></tr>
<tr><td colspan="4">Colloquium</td><td>30</td><td colspan="3"></td><td colspan="2"></td></tr>
<tr><td colspan="4">Term paper</td><td>20</td><td colspan="3"></td><td colspan="2"></td></tr>
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