STUDY PROGRAMME
FIRE SAFETY

BACHELOR ACADEMIC STUDIES

Study programme name:	**Fire Safety**
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 Disaster and Fire Safety Engineering**
Duration of studies:	**4 years**
Maximum number of students to enrol in the study programme:	**60**
Language in which the study programme is implemented:	**Serbian**

STUDY PROGRAMME OBJECTIVES

Objectives of the bachelor academic studies study programme **Fire Safety** 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 develop students' competences and broaden their academic knowledge and skills in the field of disaster and fire safety and to enable them to successfully apply scientific and professional achievements from this field.

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

- Understanding of the process of uncontrolled combustion and the accompanying chemical and physical processes and parameters;
- Identification of occupational and environmental fire and disaster hazards and risks and determination of potential scope of the accident;
- Identification of fire and disaster hazards and risks in technological processes and determination of potential scope of the accident;
- Fire and disaster risk management;
- Understanding of disaster causes, development, and consequences;
- Implementation of safety measures to minimize the risk of disasters;
- Understanding of institutional frameworks for emergency management;
- Use of fire detection and alarm systems;
- Use of fire suppression systems;
- Use and optimization of passive and active fire safety measures;
- Management of evacuation, rescue, and suppression in the event of a fire;
- Organization of emergency rescue and evacuation;
- Organization of activities and implementation of fire safety measures for buildings, devices, and equipment;
- Education and training of fire safety workers;
- Disaster recovery;
- Organization and management of the fire safety system in occupational and natural environments.

The defined aims and objectives suggest two basic intentions of the study programme – first, training for a direct transition from studying to performing disaster and fire safety 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

Completion of the bachelor academic studies study programme Occupational Safety provides students with the following **general competences**:

- Analysis of issues pertaining to occupational and environmental fires and disasters;
- Prediction of solutions and effects;
- Firm grasp of methods, procedures, and processes of risk identification;
- Development of critical thinking and approach;
- Practical application of knowledge;
- Development of communication skills in the immediate and broader surrounding;
- Development of professional and engineering ethics.

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

- resolve complex issues of fire and disaster safety;
- apply methods and procedures for assessing risk of occupational and environmental fires and disasters;
- organize and implement occupational and environmental fire and disaster safety measures;
- periodically measure and control the factors influencing occupational and environmental fires and disasters;
- produce all the required reports on the state of protection against fires, disasters, and explosions;
- prepare plans and technical documentation in the field of fire, disaster, and explosion safety;
- assess the implementation of prescribed firefighting, evacuation, and rescue measures in the event of fires and disasters;
- use information technology in the field of fire and disaster safety;
- assess the needs and implement fire and disaster safety education;
- understand and apply the paradigm of sustainable development end economic principles of occupational safety;
- implement organizational measures in the fire and disaster safety system.

Bachelor engineers of disaster and fire safety 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 **Fire Safety** is to educate students to become bachelor engineers of disaster and fire safety, which is socially justifiable and in keeping with the needs of the economy and society for the purpose of resolving complex issues in the occupational and natural environments.

The Faculty of Occupational Safety defined the education of highly competent personnel in the field of disaster and fire safety as one of its fundamental tasks and goals, in accordance with the faculty vision, mission, policy, and quality strategy. The content of the Fire Safety study programme fully corresponds to the fundamental tasks and goals of the faculty.

The study programme content helps students acquire knowledge in the fields of natural sciences, technical and technological sciences, and social sciences and humanities, which is required for programme completion. The acquired skills and competences will enable them to work on complex and multidisciplinary disaster and fire safety tasks. Accordingly, the programme is designed to provide sufficient knowledge from basic scientific disciplines (mathematics, physics, chemistry, mechanics, thermodynamics, etc.), traditional engineering disciplines (mechanical engineering, energy engineering, process systems engineering, etc.), as well as from the fields of management, education, and organization. The programme teaches students to: perform systems analysis of disaster and fire safety problems; record, analyze, and present data on the state of disaster and fire safety; understand the requirements of the disaster and fire safety system and the fire safety management system; understand the principles and educational needs in disaster and fire safety; and work as parts of a team.

In times of rapid technological development and progress, but also new potential hazards and risks of fires in the occupational and natural environments, a study programme designed in this way educates future professionals who possess the knowledge, competences, and skills that meet European and global criteria, bachelor engineers who can identify potential hazards and risks of disasters and fires and propose measures for prevention, response, and mitigation of disaster and fire effects, which makes this programme socially beneficial and justified.

ADMISSION REQUIREMENTS

The Faculty of Occupational Safety in Niš enrols 60 students in the first year of the bachelor academic studies study programme **Fire Safety**. 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' interest.

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 into 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 Fire Safety (FS) 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 36.88%;
- Professional-applicative 27.08 %.

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 21.36-21.39 (21.38 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 (9.625 weekly average), other forms of active classes 3.87-4.14 (0.50 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 fire safety. 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 their studies, students receive the academic degree

Bachelor with Honours in Disaster and Fire Safety 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.	V	Le.	IR				
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.OZOP01	Ignition and Combustion Theory	5	2	2	0	0	0	6	R	SP
22.	19.OZOP02	Applied Fluid Mechanics	5	2	2	0	0	0	6	R	SP

23.	19.OZOP03	Fire Dynamics	5	2	2	0.27	0	0	6	R	PA
24.	19.OZOP04	Emergencies	5	2	2	0	0	0	6	E	SP
	19.OZNR24	Toxicology	5	2	2	0	0	0	6	E	SP
25.	19.OZNR27	Industrial Ventilation	5	2	2	0	0	0	6	E	SP
	19.OZNR28	Pressurized Facilities and Installations	5	2	2	0	0	0	6	E	SP
26.	19.OZOP05	Fire Extinguishing Agents and Equipment	6	2	2	0	0	0	6	R	PA
27.	19.OZNR30	Electrical Hazards	6	2	2	0.53	0	0	6	R	PA
28.	19.OZNR31	Theory and Organization of Safety Education	6	2	2	0	0	0	6	R	SP
29.	19.OZOP06	Protection Against Fire and Explosions	6	2	2	0	0	0	6	R	SP
30.	19.OZOP07	Forest Fires	6	2	2	0	0	0	6	E	PA
	19.OZNR33	Electrical Facilities and Installations	6	2	2	0	0	0	6	E	SP
Total classes (lectures/exercises + other) and credits per year				20	20	0.8	0	0	60		
Total active classes per year				40.80				0	60		
FOURTH YEAR											
31.	19.OZOP08	Fire Suppression Tactics	7	2	2	0	0	0	6	R	SP
32.	19.OZOP09	Fire Detection and Alarm Systems	7	2	2	0	0	0	5	R	PA
33.	19.OZNR36	Risk Assessment Methods	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.OZOP10	Organization of Fire Protection	7	2	2	0	0	0	5	E	PA
	19.OZOP11	Evacuation and Rescue	7	2	2	0	0	0	5	E	PA
36.	19.OZOP12	Internship	7	0	0	0	0	6	3	R	PA
37.	19.OZOP13	Risk and Mitigation of Accidents	8	3	2	0	0	0	6	R	PA
38.	19.OZOP14	Fire Protection of Buildings	8	3	2	0	0	0	6	R	PA
39.	19.OZOP15	Handling of Flammable and Explosive Materials	8	2	2	0	0	0	5	E	PA
	19.OZOP16	Intervention and Rescue Equipment	8	2	2	0	0	0	5	E	PA
40.	19.OZOP17	Psychology of Groups	8	2	2	0	0	0	5	E	SP
	19.OZNR46	Health Protection	8	2	2	0	0	0	5	E	TM
41.	19.ZOP18A	Diploma Thesis – Research	8	0	0	0	4	0	5	R	PA
42.	19.ZOP18B	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	0-0.27	4	8	60		
Total active classes per year				42-42.27				8	60		
Total active classes, other classes, and credits for all years				178.89-179.14				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. Ignition and Combustion Theory
21. Applied Fluid Mechanics
22. Fire Dynamics
23. Fire Extinguishing Agents and Equipment
24. Electrical Hazards
25. Theory and Organization of Safety Education
26. Protection Against Fire and Explosions
27. Fire Suppression Tactics
28. Fire Detection and Alarm Systems
29. Risk Assessment Methods
30. Internship
31. Risk and Mitigation of Accidents
32. Fire Protection of Buildings
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 Ušćumlić (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 to 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
[5] Dimitrijević Predrag, Lukić Mladena, Marinković Nataša (2014). *Zbirka zadataka iz fizike.* Niš: Univerzitet u Nišu, Fakultet zaštite na radu u Nišu

Number of active classes (weekly)

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

Teaching methods

Lectures, calculation exercises, and laboratory work (over 10 weeks) with a multimedia presentation and 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	20		
Colloquium 2	20		
Laboratory work	10		

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 point. 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 an oblique pyramid and general plane. Section of oblique pyramid and special plane. Direct penetration method. Determination of 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 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		

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 an 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 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 gases dissolved under pressure**: Classification. Risk, packaging, and storage of gases. Containers for compressed gases and gases dissolved under pressure. 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 waste water quality. **Chemical parameters of soil**: Solid, liquid, and gaseous phases 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. **The 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: Ignition and Combustion Theory

Course status: Required | **Course code:** 19.OZOP01

ECTS credits: 6

Requirements: -

Course aim

Formation of a basis for engineering calculation of the combustion process, which pertains to stoichiometric and thermo-dynamic problems, formation of flame and combustion, flame propagation speed, and the quantity and composition of the fire effluent.

Course outcome

Students' ability to:

- independently conduct stoichiometric and thermal calculations pertaining to ignition and combustion processes;
- understand the prerequisites for ignition and combustion of solid, liquid, and gaseous fuels;
- distinguish between different combustion regimes;
- understand the mechanisms of heat transfer in ignition, combustion, and flame propagation;
- calculate combustion temperature and fire effluent quantity and composition for different combustion conditions;
- understand the mechanisms and model simple cases of combustion of materials in all three states of matter.

Course outline

Theoretical lessons

Physicochemical foundations of the combustion process. Definition of and prerequisites for combustion. Characterization of fuels. Stoichiometric calculation of the combustion process for gaseous, liquid, and solid fuels. Thermodynamics of the combustion process: Calorific value and thermal power. Methods of determining thermal power. Calorimetry. **Determination of the adiabatic temperature of combustion. Heat transfer in combustion processes:** Conduction, convection, radiation. **Chemical equilibrium:** Gibbs function. Chemical equilibrium constant. Spontaneous equilibrium. Determination of constant equilibrium. Deviation from equilibrium. **Combustion kinetics:** Global and elementary reactions. Reaction speeds for multistep mechanisms. Relationship between reaction speeds and equilibrium constants. **Kinetic flame:** Autoignition. Pilot ignition. Flame front speed. Explosive limits. **Diffusion flame. Ignition and combustion of liquid fuels:** Determination of flash point temperature. Clausius-Clapeyron equation. Speed of vapour formation. **Ignition of solid fuels:** Solid fuel ignition phases. Heat flux during fires. Ignition of thermally thin and thermally thick solids. **Fire propagation across surfaces and through solids. Fire effluent.**

Practical lessons

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

Literature

[1] Mitić Dragan, Mihajlović Emina (2000) *Metode izračunavanja temperature sagorevanja*. Niš: Univerzitet u Nišu, Fakultet zaštite na radu
[2] Protić, M. (2021) Teorija paljenja i gorenja - zbirka zadataka, Fakultet zaštite na radu u Nišu, Niš
[3] Quintiere G. James (2006) *Fundamentals of fire phenomena*. Wiley
[4] Quintiere G. James (2016) *Principles of fire behavior*. CRC Press
[5] McAllister Sara, Chen Jyh-Yuan, Fernandez-Pello A. Carlos (2010). *Fundamentals of combustion processes*. Springer

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: Applied Fluid Mechanics

Course status: Required | **Course code:** 19.OZOP02

ECTS credits: 6

Requirements: -

Course aim

Acquisition of basic knowledge about physical properties of fluids, basic equations describing fluid quiescence and motion, and real problems regarding fluid flows.

Course outcome

Students' ability to:

- solve problems pertaining to fluid quiescence and flow;
- perform calculations pertaining to hydrostatic pressure and pressure force;
- perform calculations pertaining to flow, pressure, and energy loss during fluid flow.

Course outline

Theoretical lessons

Physical properties and characteristics of fluids: Basic terms and definitions. Properties of liquids. **Fluid statics**: Basic equations and laws of fluid statics. Pressure (basic properties, basic equations). Pascal's Law. Connected vessels. Pressure force on flat and curved surfaces, walls, pipes, and tanks. **Fluid kinematics**: Continuity equation. Flow visualisation. **Fluid dynamics**: Ideal fluid dynamics (Euler-Bernoulli Equation). Fluid momentum. **Real fluid dynamics**: Navier-Stokes and Reynolds' equations. Laminar and turbulent flow. Similarity theory and dimensional analysis. **Hydraulics**: Mean values of hydro-mechanical quantities. Basic hydraulics equations. Extension of the Bernoulli equation to real liquid flow. Rectilinear and local losses of flow energy. Leaks from openings and sleeves. Simple and complex piping. Pump piping. Leaks from nozzles. Calculation of hydrant system and nozzles. Calculation of sprinkler systems and water curtains (simple and complex (branched) pipelines). Calculation of necessary quantity of air for desmoking (natural ventilation, thrust, and forced ventilation).

Practical lessons

Calculation exercises that follow the theoretical lessons

Literature

[1] Voronjec Konstantin, Obradović Nikola (1976). *Mehanika fluida*. Beograd: Građevinska knjiga
[2] Obrović Branko (2007). *Mehanika fluida*. Kragujevac: Mašinski fakultet u Kragujevcu
[3] Krsmanović Ljubisav, Saljnikov V., Šašić M., Đurić M., Aškoviić R., Đorđević V. (1979). *Zbirka zadataka iz mehanike fluida*. Beograd: Naučna knjiga
[4] Čantrak Svetislav, Benišek Miroslav (1988). *Rešeni zadaci iz Mehanike fluida*. Beograd: Građevinska knjiga
[5] Obrović Branko, Milovanović Dobrica (1982). *Mehanika fluida – zbirka rešenih zadataka*. Kragujevac: Mašinski fakultet

Number of active classes (weekly)

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

Teaching methods

Lectures, auditory and 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)	20
Activity during exercises	5	Oral exam (theoretical part of the exam)	20
Colloquium 1	20		
Colloquium 2	30		

Course name: Fire Dynamics

Course status: Required	**Course code:**	19.OZOP03

ECTS credits: 6

Requirements: -

Course aim

Acquisition of knowledge about fires as dynamic and thermodynamic processes occurring indoors or outdoors over a period of time.

Course outcome

Students' ability to:

- assess fire risk;
- predict fire dynamics based on known parameters influencing its development;
- utilize fire dynamics simulation software for the purpose of implementing appropriate preventive measures.

Course outline

Theoretical lessons

Indoor fire dynamics: **Indoor fire stages**: Pre-flashover fire stages (incipient stage, growing stage). Flashover. Post-flashover. Fire stages (developed stage, decay stage). Basic parameters of fire development within specific stages. Backdraft. Influence of environmental parameters on fire development. **Fire zones**: Combustion zone (continuous and fluctuating flame, buoyant plumes and jets of products). Thermal effect zone (heat transfer modes, thermal balance of fire). Smoke formation zone (neutral plane, mass exchange of gaseous fractions). **Temperature regime of a fire**: Nominal temperature-time curves (*BS* and *ASTM* curves, *ISO* standard fire curve, external curve, hydrocarbon curve). Parametric temperature-time curve. Temperature-time curve of a real fire. Flashover curve. Backdraft curve. **Fire classification** according to point of origin, size (local, general), combustion regime (fires dependent on mass fire load and fires dependent on ventilation), and heat release rate (t^2 fire). **Thermodynamics of fire**: Gaseous mixture of combustion products and air as an open thermodynamic system. Differential equations of mass and energy conservation and of conservation of product mixture components. Thermal regimes and temperature regimes of fires.

Outdoor fire dynamics: Fire stages. Influence of environmental parameters on fire development. **Outdoor fires**: Fires of flammable material warehouses (gases, liquids, and solids). Forest fires (types of forest fires, fire dynamics depending on the characteristics of combustible materials, terrain conditions, and climate conditions). Fires on agricultural land. Fires on non-sanitary landfills.

Practical lessons

Introduction to the ALOHA (Areal Locations of Hazardous Atmosphere) software and types of ire and explosion scenarios that the software can simulate. Modelling of toxic gas dispersion during fires or explosions. Determination of vulnerability zones according to standards for toxicity exposure, according to the upper and lower explosive limit, and according to heat flux values during exposure to the thermal effects of fires and explosions. Entry of input parameters into the software, display of calculation results in ALOHA, and export of results to one of the geographic information systems (ArcMap, Google Earth). Analysis of calculation results and proposals for taking appropriate protective measures against fires and explosions.

Literature

[1] Pešić Dušica (2019). Dinamika požara – interni materijal za pripremu ispita. Niš: Univerzitet u Nišu, Fakultet zaštite na radu u Nišu.
[2] Drysdale Dougal (2012). An Introduction to Fire Dynamics, (3rd edition). New York: Wiley & Sons.
[3] Gorbett Gregory, Pharr James, Rockwell Scott (2017). Fire Dynamics. London: Pearson Education.
[4] Parisien Marc-Andre, Batllori Enric, Miller Carol, Parks Sean (2018). Wildland Fire, Forest Dynamics, and Their Interactions. Basel: MDPI AG.

Number of active classes (weekly)									
Lectures	2	Auditory exercises	2	Other forms of classes	0.27	RS	-	Other classes	-

Teaching methods

Lectures (oral exposition, multimedia presentations, discussions), exercises (auditory and practical with PC use), 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)	10
Activity during exercises	5	Oral exam (theoretical part of the exam)	30
Colloquium 1	20		
Colloquium 2	20		
Term paper	10		

Course name: Fire Extinguishing Agents and Equipment		
Course status: Required	**Course code:**	19.OZOP05
ECTS credits: 6		
Requirements: -		

Course aim

Acquisition of knowledge about fire extinguishment mechanisms, types of extinguishing agents, their properties, advantages and disadvantages, and methods of application depending on the type of combustible material and the type of fire. Acquisition of knowledge about firefighting equipment and devices and their selection, use, and maintenance.

Course outcome

Students' ability to:

- properly select and use fire extinguishing agents and equipment depending on the type of combustible material, its location, and type of fire;
- calculate the required quantities of fire extinguishing agents;
- properly select, use, and maintain firefighting equipment.

Course outline

Theoretical lessons

General terms. Combustion rate. Catalysts, inhibitors, and retardants. **Fire extinguishing agents.** Classification of fire extinguishing agents. Extinguishing processes. Extinguishment by cooling. Extinguishment by suffocation. Inhibition effect (anticatalytic effect). **Water as a fire extinguishing agent**. Physicochemical properties of water, properties of water affecting extinguishment processes. Advantages and disadvantages of water as a fire extinguishing agent. Methods of using water as a fire extinguishing agent. Water vapour as a fire extinguishing agent. **Foam as a fire extinguishing agent.** Foam suppression mechanism, characteristics. Types of foam and method of generation. Air-mechanical foam. Foaming agents and additives for special effects, conservation agents, antifreeze agents, agents for preventing foam decomposition during contact with fuels. Foaming agent recycling. Combined extinguishing effect of foam and powder. **Powder as a fire extinguishing agent.** Suppression mechanism, area of application of powder, advantages and disadvantages. Types of fire extinguishing powder. Physical properties of fire extinguishing powder. Chemical properties. **Carbon dioxide as a fire extinguishing agent.** Physicochemical properties of carbon dioxide, suppression mechanism. Applications and limitations. Methods of using carbon dioxide as a fire extinguishing agent. **Halons as a fire extinguishing agent.** Physicochemical properties of halons, suppression mechanism, types of halons, toxic effect of halons. Methods of using halons as fire extinguishing agents. Steps to phase out halons. **Green fire extinguishing agents, types of new chemical fire extinguishing agents**. Inert fire extinguishing agents. Methods of using inert fire extinguishing agents. Pyrotechnically generated aerosols, physicochemical properties of aerosols, suppression mechanism, toxicity. Advantages of aerosol suppression devices. **Firefighting equipment. Fittings and accessories for water.** Firefighting pipes. Couplings, nozzles, dividers, other fittings. Firefighting pumps. Piston pumps. Centrifugal pumps. Water tanks. Hydrant system equipment. **Fittings and accessories for foam.** Mixer of water and of foam. Foam nozzles. Foam generator. Other accessories for foam. **Fittings and accessories for powder. Fittings and accessories for carbon dioxide. Fittings and accessories for halons**. **Fire extinguishers for early-stage suppression. Equipment for desmoking**. Other firefighting equipment. Firefighting hand tools.

Practical lessons

Exercises that follow the theoretical lessons and involve the analysis of practical examples of fire protection. They also include a project assignment – Fire Safety Measures Project. Students learn to make basic engineering calculations.

Literature

[1] Mihajlović Emina, Mlađan Dragan, Janković Žarko (2009). *Procesi i sredstva za gašenje požara*. Niš: Univerzitet u Nišu, Fakultet zaštite na radu u Nišu
[2] Kleut Nikola (2016). *Tehnološke i mere bezbednosti od požara na osnovnim instalacijama*. Beograd: AGM knjiga
[3] Kleut Nikola (2016). *Instalacije i oprema za bezbednost od požara*. Beograd: AGM knjiga

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	Oral exam (theoretical part of the exam)	40
Activity during exercises	5		
Colloquium 1	15		
Colloquium 2	15		
Project assignment	20		

Course name: Electrical Hazards		
Course status: Required	**Course code:**	19.OZNR30
ECTS credits: 6		
Requirements: -		

Course aim

Acquisition of knowledge about identification and analysis of hazardous effects of electric energy on humans and material resources, types and measures of protecting humans against electrical hazards, and control of implemented measures of protecting humans against electrical hazards.

Course outcome

Students' ability to:

- identify electrical hazards to humans and material resources;
- analyze safety measures;
- determine the safety of electrical installations, devices, and equipment;
- evaluate the effectiveness of implemented safety measures;
- assess the risk from electric energy.

Course outline

Theoretical lessons

Electrical hazards: Humans as electro-biological conductors, human body impedance, electric shock, step and touch voltage. Effects of electricity on humans. Factors of electrical hazards. **Earthing and protective conductors:** Electrical parameters of earthing systems. Electrical parameters of earth and soil structure. Materials for installing earthing and cross-section measurements. Earthing types according to shape and mode of installation. **Protection using relays:** Role and classification of relays. Triggering methods. Contacts. Types of relays (overcurrent, voltage, directional, distance, differential, time delay, and Buchholz relay). Application of relays. **Technical safety measures against electrical hazards:** Technical safety measures against electric shock (protection against direct and indirect contact with live parts), fire, overcurrent, overvoltage, and voltage generation and drop. Technical safety measures using disconnection, switching off, and functional on and off switching of an electric circuit. **Organizational safety measures against electrical hazards:** Legal requirements. Safety requirements for electricity utilization. Organization and performance of operations in a no-voltage state, near voltage, and in a voltage state.

Protective equipment and personal protective equipment against electrical hazards. Personal equipment (electrical insulation gloves, footwear, helmet, safety glasses, leather gloves, gas masks). Collective equipment (electrical insulation rods, pliers, voltage indicators, electrical fitter tools, electrical insulation mats, blankets and covers, stands, portable devices for earthing and short-circuiting). Equipment for enclosing and insulating live parts. Signs and warnings. Safety belts. Safety ropes. **Static electricity hazards and safety:** Electric charge. Discharge energy. Static electricity generation (friction, separation and contact between two materials, induction, corona). Static electricity safety measures (earthing, control of relative humidity, air ionization, antistatic preparation, increase of material conductivity, electrostatic induction). **Atmospheric discharge hazards and safety:** Atmospheric discharge generation, discharge, and hazards. Installations for protection of buildings against atmospheric discharge (lightning arrester elements, material and minimum cross-sections of conductors, efficiency and minimum required level of protection, definition of protection zones, verification and maintenance). **Maintenance, inspection, and testing of electrical installations:** Procedure and method of controlling and verifying properties, characteristics, and quality of electrical installations.

Practical lessons

Auditory exercises: Calculation of short circuit current, ground current, fault voltage and current, step and touch voltage, and conductor overheat. Calculation of touch voltage and fault current in case of direct or indirect contact with energized parts. Calculation of circuit parameters of protection against electrical hazards. Calculation of earth resistance

of a ground rod. **Laboratory work:** Introduction to the practical application of measurements of an electrical circuit, installation, and earthing system parameters, and protective measures against electrical hazards.

Literature

[1] Cadick Johan, Capelli-Schellpfeffer Mary, Neitzel, Dennis, Winfield Al (2012). Electrical Safety Handbook, 4th edition. The McGraw-Hill Companies.
[2] Janjić Aleksandar, Vučković Dragan (2020). Električne instalacije i osvetljenje. Niš: Univerzitet u Nišu, Elektronski fakultet.
[3] Đurić Milenko, Stojanović Zoran (2014). Relejna zaštita. Beograd: KIZ centar.
[4] Glavonjić Milovan, Erić Milan (2011). Priručnik za ispitivanje električnih i gromobranskih instalacija - Inženjersko tehnički priručnik. Beograd/Zemun: AGM knjiga.
[5] Scaddan Brian (2019). Design and Verification of Electrical Installations. Routledge, Taylor & Francis Group.
[6] Hydro One Networks Inc. (2013). Electrical Safety Handbook for Emergency Responders, Revised 5th Edition.

Number of active classes (weekly)

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

Teaching methods

Lectures and presentations, auditory/demonstration exercises, laboratory work, and office hours.

Grading (maximum number of points: 100)

Pre-exam requirements	Points	**Exam**	Points
Activity during exercises	10	Written exam (practical part of the exam)	10
Colloquium 1	20	Oral exam (theoretical part of the exam)	30
Colloquium 2	20		
Laboratory work	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: Protection Against Fire and Explosions		
Course status: Required	**Course code:**	19.OZOP06
ECTS credits: 6		
Requirements: -		

Course aim

Acquisition of knowledge about preventive construction, technological, and special measures for protecting buildings and technological processes in which fires and explosions are likely to occur.

Course outcome

Students' ability to:

- assess the risk of fire in buildings and during technological processes;
- assess the risk of explosions in areas containing explosive mixtures;
- implement appropriate preventive, repressive, and recovery protection measures of fire and explosion protection.

Course outline

Theoretical lessons

Fire safety system: Definition, principles, safety measures (technical, organizational, preventive, repressive, and recovery). **Preventive measures in urban planning**: Location and safe distances between structures, access roads, water supply to fire hydrant systems. **Construction fire safety measures**: Fire sectors. Firewalls. Indoor fire hydrant system. **Technological fire safety measures**: Classification of buildings according to fire risk. Hazards and safety measures in industry (wood & pulp, textile, chemical, metalworking). Fire alarm and suppression devices and installations. **Safety measures for buildings containing flammable liquids**: Location requirements for safe storage of liquids. Division of buildings into fire sectors. Fitting of buildings with fire alarm and suppression devices. **Safety measures for buildings containing flammable gases**: Location requirements for safe storage of gases. Construction and fitting of tanks with protective devices (safety reinforcement). Fire protection of tanks (fixed suppression systems). Systems for protection against heating (tank cooling systems). **Outdoor preventive fire safety measures** in nature conservation areas, during farm works, and against forest fires.

Explosive materials: explosives, gases, vapours of highly flammable liquids, water-reactive materials that create explosive gases, organic dusts, and metal dusts. **Explosive atmospheres**: containing gases and air, vapours of highly flammable liquids and air, or dusts and air. **Vulnerable areas**: Sources of hazard (permanent, primary, secondary, multiple). Hazard zones in spaces containing explosive gas and vapour mixtures (zones 0, 1, and 2). Hazard zones in spaces containing explosive dust mixtures (zones 20, 21, and 22). Determination of hazard zones. **Protection against explosions**: primary, secondary, tertiary. **Detection of explosive gases and vapours**: Fixed installations. System devices and parts. Classification. **Ventilation of explosive areas**: Areas with natural and forced ventilation. General and local ventilation. **Protection of electric devices and installations against explosions**: Electrical installations in explosive atmospheres. Classification of electric devices into groups and classes. Types of protection (flameproof enclosures, increased safety, intrinsic safety, solid powder filling, oil immersion, pressurized enclosures). **Protection of paint shops against explosions**: Hazard zones. Protection measures (location, heating, ventilation, detection of explosive gases and vapours, hydrant system, fire suppression systems). **Protection against explosions** of warehouses in which explosive mixtures are likely to form, during the cleaning of tanks for storing flammable liquids, etc.

Practical lessons

Exercises that successively follow the theoretical lessons and that comprise analyses of practical examples of fire and explosion protection of different technological systems. Presentation and defence of term papers on an assigned topic pertaining to an integrated system for protection against fire and explosions.

Literature

[1] Pešić Dušica (2019). Zaštita od požara i eksplozija – interni materijal za pripremu ispita. Niš: Univerzitet u Nišu, Fakultet zaštite na radu u Nišu.
[2] Nolan P. Dennis (2018). Handbook of Fire and Explosion Protection Engineering Principles for the Oil, Gas, Chemical, and Related Facilities, (4th Edition). Amsterdam: Elsevier Inc.
[3] Till Robert, Coon Walter (2019). Fire Protection: Detection, Notification, and Suppression. New York: Springer International Publishing.
[4] Comer C. Robert (2020). Explosion Vented Equipment System Protection Guide. New York: Wiley

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 (auditory, presentations of term papers and discussion), 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: Fire Suppression Tactics		
Course status: Required	**Course code:**	19.OZOP08
ECTS credits: 6		
Requirements: -		

Course aim

Acquisition of knowledge about extinguishment methods, organization of the firefighting service, tactical elements for suppression of specific fire types, different stages of fire, and methods of evacuation of people from buildings during a fire.

Course outcome

Students' proficiency in:

- extinguishment methods;
- organization of the firefighting service;
- methods of using fire suppression agents and equipment;
- tactical elements for suppression of specific fire types and during different fire stages;
- methods of evacuation of people from buildings during a fire.

Course outline

Theoretical lessons

Introduction: Classification of fires. Methods of fire suppression and extinguishment. Suppression by cooling. Suppression by isolation. Suppression by dilution. Suppression by chemical deceleration. **Suppression process:** Localization and extinguishment of a fire. Localization period. Extinguishment period. **Organization of the firefighting service:** Organization of the service in peacetime. Professional firefighting units. Volunteer firefighting units. Organization of the service in wartime. **Firefighting management and its role:** Fire suppression staff. Definition of suppression tasks. determination of collaboration sectors. Determination of a decisive action course. Management of large fire suppression actions. **Primary actions of firefighting units, fire reconnaissance, development of manpower and equipment for suppression:** Evacuation of people from burning buildings. Opening and disassembly of building structures. Evacuation and protection of property. Special actions of firefighting units: rescue from rubble, rescue after traffic accidents. **Calculations of fire suppression agents and equipment:** Consumption of suppression agents. Necessary amounts. Intensity of agent utilization. Calculation of water consumption through nozzles with different diameters. Transient parameters for calculations of suppression agents and equipment. Determination of necessary equipment. **Operational plans of suppression:** Methodology of calculations for the operational plan. Operational evacuation map. **Notification system:** Organization of fire notification during peacetime and wartime. Notification devices. **Fire suppression in specific residential, public, and industrial buildings:** Particularities of fire suppression. Industrial structures. Particularities of industrial fires. Fire suppression in warehouses storing solids, liquids, and gases. Wood processing industry, food industry, petroleum industry, petrochemical industry. Artificial fertilizers, explosive manufacturing factories, electronic industry, substations. Fire suppression in open spaces. Fire suppression in forests. Fire suppression in rural areas. Fire suppression on means of transport. Fire suppression at airports. **Fire safety during wartime.** Wartime causes of fire. Fire suppression in contaminated areas. Organization of fire safety during wartime.

Practical lessons

Calculation exercises: Completion of tactical assignments with calculations for required suppression agents and equipment. **Auditory methodological exercises.** Operational suppression plans for specific buildings. **Demonstration exercises.** Students witness practical drills performed by the local fire department using fire engines, pumps, and other equipment.

Literature

[1] Cvetanović Sveta (2019). *Taktika intervencija i spasavanja - interni materijal za pripremu ispita.* Niš: Univerzitet u Nišu, Fakultet zaštite na radu

[2] Karabasil Dragan, Jakovljević Vladimir (2007). *Ekološke intervencije*. Novi Sad: Visoka tehnička škola, Novi Sad
[3] Mihajlović Emina, Mlađan Dragan, Janković Žarko (2009). *Procesi i sredstva za gašenje požara*. Niš: Univerzitet u Nišu, Fakultet zaštite na radu
[4] Mlađan Dragan (2009). *Sprečavanje i suzbijanje požara, havarija i eksplozija*. Beograd: KPA; Beograd

Number of active classes (weekly)

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

Teaching methods
Lectures, tactical assignments, calculation exercises, and practical training

Grading (maximum number of points: 100)

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

Course name: Fire Detection and Alarm Systems

Course status: Required | **Course code:** 19.OZOP09

ECTS credits: 6

Requirements: -

Course aim

Study of the operating principles, methods of realization, and basic rules for using different types of fire detectors, fire alarm systems, and devices for local and remote alarm signalling.

Course outcome

Students' ability to:

- identify the needs for installing a fire detection system;
- select appropriate detector types according to the contents of a building and the work and technological process performed within;
- select the type of fire alarm system according to the contents of a building and the work and technological process performed within;
- consider all the necessary elements for the design of a fire alarm system.

Course outline

Theoretical lessons

Basic terms and definitions. History of fire alarm systems. Standards and regulations. Detectable combustion products. **Fire development stages in terms of detection**. Possibilities of detecting combustion products. Indoor fire development. Detection of fire parameters. **Fire detectors.** Definition and general characteristics of fire detectors. Classification of fire detectors according to different criteria. **Operation principles and methods of realization of fire detectors.** Manual detectors. Automatic fire detectors. Heat detectors. Smoke detectors. Flame detectors. Carbon monoxide detectors. Aspirating smoke detectors. Multi-sensor fire detectors. Linear heat detectors. Linear smoke detectors. **Fire alarm central station.** Basic functions. Alarm functions. Management functions of the central station. Central station location. **Types of fire alarm systems**. Topology of fire alarm systems. Conventional fire alarm systems. Addressable fire alarm systems. Connection of fire alarm systems to other safety systems. **Local and remote alarm signalling**. Audio signalling. Visual signalling. **Organization of fire alarm systems.** Division of protected area into fire alarm zones. Physical organization of zones. Two-zone and multi-zone dependence. Physical organization of addressable loop. False alarms in a fire alarm system. **Introduction to the design of fire alarm systems.** Design fundamentals. Elements of system design.

Practical lessons

Exercises follow the theoretical lessons. Auditory exercises include the presentation and analysis of the operation of specific components and devices of fire alarm systems. Auditory exercises also include detailed analyses of specific parts of completed fire alarm systems that have already been implemented and are operational in different buildings with different types of work and technological processes.

Literature

[1] Blagojević Milan (2004). Sistemi za otkrivanje i dojavu požara. Niš: Univerzitet u Nišu, Fakultet zaštite na radu u Nišu.
[2] Blagojević Milan (2015). Alarmni sistemi. Niš: Univerzitet u Nišu, Fakultet zaštite na radu u Nišu.
[3] Kleut Nikola (2016). Instalacija i oprema za bezbednost od požara. Beograd/Zemun: AGM knjiga.

Number of active classes (weekly)

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

Teaching methods

Lectures, auditory exercises, presentation and analysis of examples of installed conventional and addressable fire alarm systems, 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)	20
Activity during exercises	5	Oral exam (theoretical part of the exam)	20
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: Internship

Course status: Required	**Course code:**	19.OZOP12

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 fulfill 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: Risk and Mitigation of Accidents		
Course status: Required	**Course code:**	19.OZOP13
ECTS credits: 6		
Requirements: -		

Course aim

Acquisition of knowledge about procedures and methodological approaches for identifying risk-prone buildings, determining possible accident level, implementing safety measures to minimize risk, and selecting remediation stages and procedures.

Course outcome

Students' ability to participate in the creation and verification of the following documents for companies and local self-governments:

- accident prevention policy;
- safety report;
- disaster risk assessment;
- protection plan against large-scale chemical accidents, mitigation plan, safety and rescue plan, and disaster risk reduction plan.

Course outline

Theoretical lessons

Hazards: Accidents and emergencies. System for large-scale accident safety management. General risk management framework according to ISO 31000. **Risk of large-scale accidents**: Seveso facilities. Globally harmonized system for classification and labelling of hazardous materials in Seveso facilities (GHS/CLP system). Definition of hazardous buildings. Determination of a building's Seveso compliance. Block diagram of risk management in Seveso facilities. **ARAMIS risk assessment methodology**: Application of ARAMIS in Seveso facilities. Identification of critical points and potential hazard sources – MIMAX method. Determination of potentially hazardous equipment in a facility. Determination of critical events. Creation of the diagram. **Presentation of a possible course of events:** Calculation of critical event frequency. Assessment of frequency of initiating events. Determination of safety functions and safety barriers in the fault tree. Assessment of safety barrier performance. **Calculation of critical event frequency**: Assessment of critical event frequency. Calculation of frequencies of hazardous effects. Assessment of impact class of hazardous effects. Building a risk matrix. The worst possible accident scenario. The most common accident scenario. Selection of a reference accident scenario. **Accident level analysis**. **Internal safety plan. External safety plans. Disaster risk assessment**. **Accident mitigation: mitigation plan elements.** Situational assessment during mitigation. Material and human resources for chemical accident mitigation. Groups of mitigation measures for specific classes of hazardous materials. Decontamination. Mitigation plan for fire and explosion recovery. Mitigation plan for hazmat leak recovery. Accident report.

Practical lessons

Auditory exercises that follow the theoretical lessons, presentation and defence of term papers on topics covered during theoretical lessons. Practical lessons include risk assessments for selected facilities using ARAMIS methodology and relevant regulations.

Literature

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

[2] Nikolić Vesna, Živković Nenad (2010). *Bezbednost u radnoj i životnoj sredini, vanredne situacije i obrazovanje*. Niš: Univerzitet u Nišu, Fakultet zaštite na radu u Nišu

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

[4] *Priručnik za razvrstavanje i utvrđivanje prioriteta među rizicima izazvanim velikim nesrećama u procesnoj i srodnim industrijama* (2001). Zagreb: IAEA-TECDOC-727, Ministarstvo zaštite okoliša i prostornog uređenja

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.

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: Fire Protection of Buildings

Course status: Required | **Course code:** 19.OZOP14

ECTS credits: 6

Requirements: -

Course aim

Acquisition of theoretical knowledge about fires in buildings, fire resilience of building structures, and technical measures of fire prevention for buildings with various purposes.

Course outcome

Students' ability to:

- calculate the fire risk for buildings;
- create emergency evacuation plans and fire procedures;
- create main fire protection projects;
- create fire protection plans for buildings.

Course outline

Theoretical lessons

Construction materials: classification of materials according to their susceptibility to ignition and combustion (non-flammability, flammability, flame propagation, heat release, smoke formation), behaviour of materials (concrete, steel, reinforced concrete, masonry materials, wood) at high temperatures. **Fire load of buildings:** mass and thermal load, specific fire load. **Fires in buildings:** fire dynamics, fire classification (according to combustion regime, heat release rate, and size). **Fires and building structures:** effect of fires on building structures (thermal and mechanical effect), structural response to fire (thermal and mechanical). **Fire resilience of building structures**: criteria, degree of resilience, resilience classes. **Concept of fire protection of buildings during design** (built-in safety measures): measures for preventing fire propagation from one building to another, access roads and clearances for the intervention of fire and rescue units, selection of construction materials with a required fire resilience, fire protection of structural elements, measures for preventing fire propagation inside a building. **Measures of active fire protection**: fixed systems for detection of explosive and flammable gases, systems for fire alarm and detection (fire detectors – manual and automatic, fire alarm central stations), fixed fire suppression systems (hydrant system, fixed systems for water suppression: sprinkler and drencher installations, water curtain, fixed systems for suppression with powder, carbon dioxide, Inergen®, and foam). Smoke and heat control systems. Hand and wheeled fire extinguishers. **Fire evacuation**: evacuation routes, evacuation corridors. **Fire protection of buildings**: fire protection of semi-basements and basements, ground-level buildings, multi-storey buildings, high-rise buildings, and public buildings (schools, hospitals, hospitality establishments, public garages, etc.), production plants, paint shops, warehouses storing flammable and explosive materials. **Methodology for creating the main project and plan for fire protection of buildings.**

Practical lessons

Calculation of a building's fire load, fire duration, and evacuation time.

Creation of an emergency evacuation plan and fire procedures, the main fire protection project, and the fire protection plan. Field work.

Literature

[1] Pešić Dušica, Raos Miomir (2017). Požari i građevinske konstrukcije (monografija nacionalnog značaja), Niš: Univerzitet u Nišu, Fakultet zaštite na radu u Nišu.
[2] Laban Mirjana et al. (2020). Fire Safety in Buildings: A Western Balkan Approach and Practice. Novi Sad: Faculty of Technical Sciences.
[3] Buchanan Andrew, Abu Anthony (2017). Structural Design for Fire Safety. New York: Wiley & Sons.
[4] John A. Purkiss, Long-Yuan Li (2017). Fire Safety Engineering Design of Structures. Boca Raton: CRC Press.

Number of active classes (weekly)									
Lectures	3	Auditory exercises	2	Other forms of classes	-	RS	-	Other classes	-
Lectures (oral exposition, multimedia presentations, discussions), exercises (calculation problems, individual presentation of term papers followed by a discussion), 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: Diploma Thesis – Research

Course status: Required | **Course code:** 19.ZOP18A

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 to 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 solution. 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.ZOP18B

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 in 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. Toxicology
5. Industrial Ventilation
6. Pressurized Facilities and Installations
7. Forest Fires
8. Electrical Facilities and Installations
9. Safety Application of Information Technology
10. Integrated Management Systems
11. Organization of Fire Protection
12. Evacuation and Rescue
13. Handling of Flammable and Explosive Materials
14. Intervention and Rescue Equipment
15. Psychology of Groups
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 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: 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: Industrial Ventilation

Course status: Elective | **Course code:** 19.OZNR27

ECTS credits: 6

Requirements: -

Course aim

Acquisition of theoretical and practical knowledge about industrial ventilation systems. Identification of hazard sources in technological processes and selection of an adequate ventilation system.

Course outcome

Students' knowledge about:

- industrial systems;
- ventilation systems;
- ventilation techniques;
- types of ventilation systems.

Course outline

Theoretical lessons

Definition and classification of industrial facilities. Classification of ventilation systems. Natural ventilation. Mechanical ventilation. Elements of ventilation systems. Ventilators. Air distribution system. **Local exhaust systems.** Wood processing industry. Chemical industry. **Particularities of ventilation systems in different industrial facilities.** Petrochemical industry. Commercial kitchens. Underground mines. Production plants for highly flammable materials. **Specific ventilation systems**. Ventilation systems in underground parking garages. Ventilation in tunnels. **Equipment intended for use in potentially explosive atmospheres.** ATEX Directive. Quality requirements for equipment intended for use in potentially explosive atmospheres. Equipment labelling. Quality labels. CE marking. Ex marking.

Practical lessons

Auditory/calculation exercises that follow the theoretical lessons

Literature

[1] Isailović Miodrag (2007). *Tehnički propisi o zaštiti od požara i eksplozija*. Beograd: SMEITS
[2] Industrial ventilation: *A Manual of Recommended Practice*, 23rd edition. USA: ACGIH
[3] Perišić Živojin (1994). *Ventilacija porodičnih i komercijalnih kuhinja*. Beograd: SMEITS
[4] Goodfellow Howard (2001). *Industrial Ventilation Design Guidebook*. USA: Academic Press, Elsevier

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.

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: Pressurized Facilities and Installations

Course status: Elective | **Course code:** 19.OZNR28

ECTS credits: 6

Requirements: -

Course aim

Acquisition of knowledge about pressurised facilities and installations, their operation, and safe handling. Understanding of how measurement, control, and safety equipment works. Acquisition of knowledge about hazards and harms during work with pressurised facilities and installations and about appropriate safety measures.

Course outcome

Students' ability to:

- describe and classify pressurized facilities and installations and conditions of transportation, mounting, and use;
- describe and mark pressure vessels and installations and use operational, measuring, and safety reinforcement and design materials;
- analyze hazards during handling, take appropriate safety measures, and comply with the legislation;
- perform basic calculations of pressure vessels and installations, describe the methods of fluid inspection, storage, and use;
- identify energy-producing fluids and industrial gases, interpret hazards and harms, and take safety measures.

Course outline

Theoretical lessons

Theoretical foundations: Definition of pressurized facilities, vessels, and installations. Classification according to different criteria. Safety measures during work with pressurized facilities and installations. Standards and legislation. **Pressure vessels:** Heated pressure vessels, steam boilers, steam overheaters, and water heaters. Non-heated pressure vessels, surface and ground reservoirs. Mobile pressure vessels and portable tanks, tank trucks, tank wagons, ship tankers, air tankers, containers, vats, barrels, and bottles. Conditions of transportation, mounting, and use of mobile and stationary pressure vessels. Labelling of pressure vessels. Materials for pressure vessel design. Types of pressure vessel constructions. Basic calculations of pressure vessels. Pressure vessel testing. Safety measures, handling, and maintenance of pressure vessels. Heat, electricity, and corrosion protection of pressure vessels. **Pressure installations:** Basic definitions and classifications. Labelling of pressure installations. Materials. Design of pressure installations. operational, measuring, and safety reinforcement of pressure installations. Testing of pressure installations. Safety measures, handling, and maintenance of pressure installations. Heat, electricity, and corrosion protection of pressure installations. **Energy-producing fluids and industrial gases:** Definition and classification of energy-producing fluids and industrial gases, air, oxygen, acetylene, natural gas, propane-butane, ammonia, nitrogen, carbon dioxide, water/water vapour, argon, hydrogen. Reinforcement, vessels, and installations for energy-producing gases – natural gas, propane-butane, LPG.

Practical lessons

Calculation exercises that follow the theoretical lessons. Term paper (project assignment)

Literature

[1] Raos Miomir (2019). *Zaštita na radu sa postrojenjima pod pritiskom – interni materijal za pripremu ispita.* Niš: Univerzitet u Nišu, Fakultet zaštite na radu u Nišu

[2] Isailović Miodrag, Petrović Aleksandar, Bogner Martin, Mitrović Nenad (2013), *Propisi o opremi pod pritiskom*. Beograd: ETA

[3] Bajić Darko (2011). *Posude pod pritiskom i cjevovodi*. Crna Gora: Univerzitet Crne Gore, Mašinski fakultet

[4] Mihajlović Radomir (1980). *Zaštita pri radu sa postrojenjima pod pritiskom*, izvod iz Lectures. Niš: Univerzitet u Nišu, Fakultet zaštite na radu u Nišu

[5] Đurić Vojislav, Bogner Martin (1980). *Parni kotlovi - teorijske osnove i proračuni*, Beograd: RSO 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

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		
Term paper	10		

Course name: Forest Fires

Course status: Elective | **Course code:** 19.OZOP07

ECTS credits: 6

Requirements: -

Course aim

Acquisition of knowledge about forest fires in order to predict their outbreak, about detection, prevention, and propagation methods, and about basic measures of preventive protection, suppression, and recovery of the fire-afflicted terrain.

Course outcome

Students' ability to:

- assess forest fire hazards for a specific terrain;
- select modern equipment for monitoring and early detection of forest fires;
- select adequate equipment for prevention of forest fire propagation and for suppression;
- select terrain recovery measures after a fire.

Course outline

Theoretical lessons

Basic knowledge about forest fires: Statistics and classification of forest fires. Factors influencing outbreak. **Classification of combustible forest materials:** Parameters determining burning velocity. Characteristics of combustible materials determining their moisture content. Structure of forest stands. **Basic combustion aspects in forest fires:** Temperature. Velocity. Concentration of effluent and flame height. Kinetic and diffusion flame. Flame propagation. **Forest fire propagation models:** Basic elements of models. Connection of atmospheric models and forest fire models. Overview of models. **Detection and monitoring of forest fires:** Integrated approach to forest fire detection. Methods for evaluating and monitoring the intensity of forest fires. Use of sensors and detectors. Use of existing telecommunication and IT infrastructure. Use of modern technological solutions: satellites, thermal vision cameras, and UAVs. **Forest fire suppression tactics:** Forest fire suppression stages. Tactics. Suppression methods. Suppression techniques. Use of software for forest fire simulation. **Forest fire suppression equipment:** Manual equipment. Mobile portable equipment. Special vehicles. **Impact of forest fires on soil:** Physical and chemical impacts. soil erosion after forest fires. Impact of forest fires on nutrient cycle in the forest biocenosis. Impact of forest fires on vegetation. **Emissions from forest fires:** Emission assessment. Emission measurement. Empirical dependencies. **Forest fire prevention:** Preventive measures. Controlled burning in areas with a high risk of forest fire outbreaks. **Rehabilitation and recovery of areas afflicted by forest fires.**

Practical lessons

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

Literature

[1] Miyanishi Kiyoko (2001). *Forest Fires: Behavior and Ecological Effects*. Elsevier
[2] Čočev Valentin (2014). *Gorski požari*. IK Svetovit
[3] John J. Qu., Hao, X. (2013). *Remote Sensing and Modeling Applications to Wildland Fires*. Springer
[4] Heikkilä V. Timo, Grönqvist Roy, Jurvélius Mike (2010). *Wildland fire management: handbook for trainers*. FAO
[5] Cerda Artemi (2009). *Fire effects on soils and restoration strategies (Vol. 5).* USA: CRC Press

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	25		
Term paper	25		

Course name: Electrical Facilities and Installations		
Course status: Elective	**Course code:**	19.OZNR33
ECTS credits: 6		
Requirements: -		

Course aim

Acquisition of knowledge about the electric energy system, types and modes of execution, and constituent elements of electrical facilities and installations.

Course outcome

Students' knowledge about:

- the electric energy system;
- types of electrical facilities, elements of electrical facilities, and their characteristics;
- execution and operation modes of electrical facilities;
- types of electrical installations and their constituent elements and characteristics;
- selection and placement of electrical installations.

Course outline

Theoretical lessons

Electric energy system: Subsystem for production: Power stations. Synchronous generators. Transformers. Switches and other commutation devices. Busbars. Cables. Surge arresters. Auxiliary equipment and devices. **Subsystem for transmission:** High-voltage power lines. Switchgears. Auxiliary equipment and devices. **Subsystem for distribution:** Power distribution aerial and power cable lines. Transformer substations. Commutation devices on high- and low-voltage side. Auxiliary equipment and devices. **Subsystem for consumption:** Load nodes. **Electrical installations: Terms, definitions, and legislation. General characteristics and classification of electrical installations:** Nominal voltage and voltage bands. Characteristics of electrical distribution systems. Receiver and consumer facility power. Classification of external influences. **Basic electrical installation components, devices, and equipment:** Electrical conductors. Switch components. Protective components. Connector components. Components, devices, and equipment for timer programming, control, command, and signalling. Electrical measuring instruments, measuring devices, and measuring equipment. Distribution devices. Non-electrical components. **Special-purpose electrical installations:** Electrical installations at construction sites, in agriculture, in limited conduction spaces, in areas with bathtubs or showers, in camps, in spaces filled with flammable dust. **Technical documentation, selection, layout, and connection:** Electrical installation project. Connection of buildings to a low-voltage network. Layout and connection of selected equipment. Selection and placement of electrical equipment depending on external factors. **Maintenance, inspection and testing of electrical installations:** Procedure, method of control, and verification of properties, characteristics, and quality of electrical installations.

Practical lessons

Auditory exercises: Calculus problems (alternating current electric circuits, parameters of overhead lines, transformers, calculation of voltage drop and power and energy loss. Low-voltage network load, determination of cable size for low-voltage lines, voltage drop in low-voltage networks, conductor load, selection of conductors and cables). Practical introduction to elements and modes of execution of specific types of electrical facilities and installations.

Literature

[1] Dotlić Gojko (2013). Elektroenergetika kroz standarde, zakone, pravilnike, odluke i tehničke preporuke: tumačenja, komentari, primeri. Beograd: Savez mašinskih i elektrotehničkih inženjera i tehničara Srbije (SMEITS).
[2] Đurić Milenko (2017). Elementi elektroenergetskih sistema EES-a. Zemun: AGM knjiga.
[3] Janjić Aleksandar, Vučković Dragan (2020). Električne instalacije i osvetljenje. Niš: Univerzitet u Nišu, Elektronski fakultet.
[4] Milanković Miloš, Perić Dragoslav, Vlajić-Naumovska Ivana (2016). Osnovi

elektroenergetike. Beograd: Visoka škola elektotehnike i računarstva strukovnih studija.
[5] Đurić Milenko, Ilić Veselin (2017). Visokonaponska razvodna postrojenja. Beograd/Zemun: AGM knjiga.
[6] Žarić Miro (2013). Savremene električne instalacije. Banja Luka: Savez energetičara.

Number of active classes (weekly)

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

Teaching methods

Lectures and teacher presentations, auditory and demonstration 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)	10
Activity during exercises	5	Oral exam (theoretical part of the exam)	30
Colloquium 1	20		
Colloquium 2	30		

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 an 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: Organization of Fire Protection		
Course status: Elective	**Course code:**	19.OZOP10
ECTS credits: 5		
Requirements: -		

Course aim

Acquisition of knowledge about fire protection subjects, about organization and activities of professional and volunteer firefighting, and about types of fire protection activities and their organization in companies.

Course outcome

Students' ability to:

- organize and manage a fire protection system;
- organize fire protection activities;
- implement preventive fire safety measures.

Course outline

Theoretical lessons

Definition, subject matter, and content of fire protection organization: Fire protection principles. State of fire protection. Fire protection subjects. **Role of state bodies in fire protection**: Fire safety regulations and standards. Fire protection strategy. Purview of the Ministry of Internal Affairs. Supervision and administrative supervision. Methods and procedures of inspection. **Bodies of autonomous provinces. Bodies of local self-government units**. **Obligations of companies regarding fire protection:** Regulatory framework of fire protection. Fire protection plan. Fire safety rules. Organization of fire protection activities. Categorization according to fire vulnerability. Fire safety training. Implementation of ISO standards in the fire protection system. Management of documents in the service of fire protection. **Ministry of Defence and Serbian military. Preventive measures of fire safety**. **Fire safety management:** Human behaviour during emergencies. Communication in fire and rescue interventions. Motivation of fire safety managers. Human resource management and work motivation of members of fire and rescue units. **Professional firefighting units:** Organization of professional firefighting services. **Volunteer firefighting societies and associations**. **Obligations, rights, and responsibilities of citizens as subjects of the fire protection system**. **Insurance companies in fire protection. Activities of companies specializing in security:** Role and tasks of security workers in the fire protection of buildings.

Practical lessons

Auditory exercises that follow the theoretical lessons. Presentation and defence of term papers. Analysis of practical examples pertaining to the organization and management of a fire protection system.

Literature

[1] Živković Snežana (2011). Organizacija zaštite od požara. Niš: Univerzitet u Nišu, Fakultet zaštite na radu u Nišu.
[2] Della-Giustina E. Daniel (2014). Fire safety management handbook. CRC Press.
[3] Evans Thomas Rhys, Gail Steptoe-Warren (2019). Applying Occupational Psychology to the Fire Service: Emotion, Risk and Decision-Making. Springer
[4] Murphy Peter, Greenhalgh Kirsten (2018). Fire and rescue services. Nottingham: Springer International Publishing.
[5] Hurley Morgan, Gottuk Daniel, Hall John, Harada Kazunori, Kuligowski Erica, Puchovsky Milosh, Wieczorek Christopher (Eds.). (2015). SFPE handbook of fire protection engineering. Springer.

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

Teaching methods Lectures, writing of term papers, discussions, 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: Evacuation and Rescue

Course status: Elective | **Course code:** 19.OZOP11

ECTS credits: 5

Requirements: -

Course aim

Acquisition of knowledge about organization of evacuation and rescue in the event of a fire or other accidents considering the nature, scope, effects, location, and other factors of the accident.

Course outcome

Students' ability to:

- organize and manage the evacuation of people and property in the event of a fire or other accident;
- create an evacuation plan;
- organize and manage rescue of people in the event of a fire or other accident.

Course outline

Theoretical lessons

Evacuation. Evacuation and rescue – basic terminology. Emergency event and ensuing panic. Fire evacuation. Evacuation in special circumstances. Evacuation of animals and property. Calculation of the time required for evacuation from a building. The time required for evacuation from an indoor area. The time required for evacuation from a building. Evacuation exits and routes. Evacuation exits. Evacuation routes. Safety lighting. Evacuation assembly points. Creation of the evacuation and rescue plan. Textual part of the evacuation plan. Graphical part of the evacuation plan. Designation of persons to conduct evacuation and rescue. End of evacuation. Creation of the evacuation and rescue team. Role of leader/commander of evacuation and rescue. Leading evacuation and rescue. Situational assessment. Decision. Orders. Rescue equipment. **Rescue.** Procedures for handling injured persons. Examination of injured persons. Certain signs of death. Unconscious state. First aid. Position of injured persons. Care of injured persons – procedures following the first aid. Transport of injured persons. Rescue from afflicted buildings. Rescue using one rescuer / two or more rescuers. Rescue from heights. Rescue from depths. Fire rescue. Burns. Carbon monoxide poisoning. Rescue from rubble. Rescue after explosions. Identification of signs of blast injury. Procedures for handling injured persons. HAZMAT rescue. Basic procedures when dealing with hazardous materials according to their class. HAZMAT procedures and first aid. signs of poisoning. Rescue after thunder strike and electric shock. Rescue of animals. Rescue of property.

Practical lessons

Exercises that follow the theoretical lessons and include a project assignment – Evacuation Plan – with a theoretical and graphic portion.

Literature

[1] Mihajlović Emina (2016). *Civilna zaštita*. Niš: Univerzitet u Nišu, Fakultet zaštite na radu u Nišu

[2] Pehar Rade (2010). *Evakuacija*. Zagreb: Zavod za istraživanje i razvoj sigurnosti

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	Oral exam (theoretical part of the exam)	40
Activity during exercises	5		
Colloquium 1	15		
Colloquium 2	15		
Graphic assignment	20		

Course name: Handling of Flammable and Explosive Materials

Course status: Elective | **Course code:** 19.OZOP15

ECTS credits: 5

Requirements: -

Course aim

Acquisition of knowledge about specific hazards and safety measures during production, transport, storage, and use of flammable and explosive materials.

Course outcome

Students' ability to:

- distinguish between flammable and explosive materials;
- identify hazards and implement safety measures when handling flammable and explosive materials.

Course outline

Theoretical lessons

General terminology on explosive and flammable materials: Definition and classification of explosive and flammable materials. Classification of explosive and flammable materials. **Explosive materials and items:** Military-grade explosive materials. Nitrocellulose, pentaerythritol, tetranitrate, mono-, di-, and trinitrotoluene. Production principles, intermediary transport, storage, presentation of typical frequent cases. Initiating explosive materials. Mercury fulminate, lead azide, lead trinitroresorcinol. Principle of production, toxicity, and hazard. Safety measures during transportation. Gunpowder. Safety measures during gunpowder transportation. **Objects charged with explosives:** Principles of explosive charging. Safety measures during transportation. **Lighters, fireworks, and similar items:** blasting caps, electric blasting caps and electric detonators, slow-burning detonating cord. Production principles. Application. Safety measures during transportation. **Gases:** Compressed gases. Production principles. Safety measures during transportation. Liquefied gases or dissolved gases. Safety measures during transportation. **Flammable liquids:** Definition and classification, production principles. Safety measures during transportation. **Flammable solids:** Classification. Production principles. Safety measures during transportation. **Materials susceptible to spontaneous ignition:** Definition of materials susceptible to spontaneous ignition. Safety measures and fire safety measures during transportation. **Materials that generate flammable gases in contact with water:** Introduction and definition. Safety measures during transportation. **Oxidizing materials:** Safety measures during transportation. **Organic peroxides:** Safety measures.

Practical lessons

Calculation exercises. Determination of safe distances from warehouses. Determination of safe distances from public buildings. **Demonstration exercises.** Demonstration of exercises performed at companies for production, storage, and transport of flammable and explosive materials.

Literature

[1] Cvetanović Sveta (2019). *Rukovanje zapaljivim i eksplozivnim materijama – interni materijal za pripremu ispita*. Niš: Univerzitet u Nišu, Fakultet zaštite na radu u Nišu

[2] Maksimović Petar. (1972). *Tehnologija eksplozivnih materija*. Beograd: Vojnoizdavački zavod

[3] Trajkovski Ljupčo. (1996). Priručnik za bezbedna rabota pri rukovanje so eksplozivni sredstva i pri miniranje vo stopanstvoto, Kočani

Number of active classes (weekly)

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

Teaching methods

Lectures, tactical assignments, calculation exercises, and practical training

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: Intervention and Rescue Equipment

Course status: Elective | **Course code:** 19.OZOP16

ECTS credits: 5

Requirements: -

Course aim

Acquisition of knowledge about types, characteristics, use, and maintenance of firefighting devices and equipment used in firefighting as well as in other emergencies.

Course outcome

Students' ability to:

- select suitable intervention and rescue equipment;
- handle intervention and rescue equipment;
- use intervention and rescue equipment during emergency interventions.

Course outline

Theoretical lessons

Definition of intervention and rescue equipment. Classification of equipment: personal, collective, vehicles, machines, devices, special radio devices, detectors, dosimeters, anemometers, impromptu suppression materials). **Firefighting equipment**: mobile equipment, fire hose adapters and fittings (in buildings, open space, traffic). **Rescue equipment**: land, water, and air transport, floods, earthquakes. **Equipment for HAZMAT interventions**: discharge prevention, neutralization of spilled materials, transport of hazardous materials. **Protective equipment**: against heat, against chemicals, for victims in afflicted zones during interventions. **Maintenance of intervention and rescue equipment. Hydrant system**: Characteristics and operation of hydrant systems. Calculation of hydrant systems.

Practical lessons

Demonstration exercises. Examination of extinguishers for initial fire suppression. Examination of equipment such as ropes, ladders, berthing apparatuses, hydrant systems, etc.

Literature

[1] Cvetanović Sveta (2019). *Oprema za intervenciju i spasavanje.* Niš: Univerzitet u Nišu, Fakultet zaštite na radu (interni materijal za pripremu ispita)
[2] Cvetanović Sveta (2019). *Mobilna oprema*. Niš: Univerzitet u Nišu, Fakultet zaštite na radu (interni materijal za pripremu ispita)
[3] Šmejkal Zdenko (2002). *Uređaji, oprema i sredstva za gašenje i zaštitu od požara*. Zagreb: Zagrebinvest

Number of active classes (weekly)

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

Teaching methods

Lectures and demonstration 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	15		
Colloquium 2	15		
Term paper	20		

Course name: Psychology of Groups		
Course status: Elective	**Course code:**	19.OZOP17
ECTS credits: 5		
Requirements: -		

Course aim

Acquisition of knowledge about psychological personality traits for work and behaviour under uncertain circumstances, about group rules, and about emergency procedures.

Course outcome

Students' ability to:

- perform tasks in groups for emergency events or accidents;
- identify and promptly and adequately eliminate specific states and types of behaviour of individuals;
- make decisions based on group psychology and individual behaviour within a group;
- encourage group professionalism and facilitate individual involvement in professional work.

Course outline

Theoretical lessons

Problem of studying groups: Development of psychological study of groups. **Group types and their characteristics**: Definition of a group. Unstructured groups. Structured groups. Small groups. Different groups according to special criteria. Organization. Large social groups. **Group formation and maintenance**: Group origins. Group development. Requirements for group maintenance and functioning. Group cohesion. **Group relations**: Group structure. Power structure. Communication structure. Sociometric structure. Status structure. **Leadership**: Definition of a leader. Leadership activities and functions. **Group processes**: Definition and characteristics of group norms. Conformity. Cooperation and competition within groups. Group problem solving and decision making in a group. Group decision-making. **Spontaneous groups and crowd, laws of crowd behaviour, and crowd phenomena**: Understanding a crowd. Crowd structure and formation stages. **Social and psychological investigation of human behaviour in a crowd**. **Characteristics of human behaviour in a crowd**: Characteristics of human mental states. Systematization of human mental states. **Specific nature of fear overcoming of fear during emergencies**: Types of fear. Fear as a protective mechanism. Methods and rules for overcoming fear. **Specific nature of panic during emergencies:** Definition of panic. Characteristics of panic during emergencies. Panic in the event of an environmental disaster. Panic as a form of psychosocial epidemic. Prevention and elimination of mass panic. Prevention of panic during evacuation.

Practical lessons

Exercises include presentation and defence of term papers on topics covered during theoretical lessons.

Literature

[1] Živković Snežana (2012). Psihologija grupa. Niš: Univerzitet u Nišu, Fakultet zaštite na radu u Nišu.
[2] Živković Snežana (2013). Ponašanje ljudi u vanrednim situacijama, Komunikacija i ljudsko iskustvo - tematski zbornik. Niš: Univerzitet u Nišu, Filozofski fakultet.
[3] Živković Snežana, Čabarka Milanko (2011). Specifičnosti panike u vanrednim situacijama, Bezbednost. Beograd: Ministarstvo unutrašnjih poslova Republike Srbije.
[4] Morais Catarina, Randsley de Moura Georgina (2018). In the Psychology of Ethical Leadership in Organisations: Implications of Group Processes. Palgrave Macmillan, Cham
[5] O'Doherty C. Kieran, Hodgetts Darrin (2019). The SAGE handbook of applied social psychology. Sage

Number of active classes (weekly)									
Lectures	2	Auditory exercises	2	Other forms of classes	-	RS	-	Other classes	-
Teaching methods Lectures, writing of term papers, discussions, 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: 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 on 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

[2] Blagojević Ljiljana (2012). *Životna sredina i zdravlje*. 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, 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	30		
Term paper	20		