

STUDY PROGRAMME OCCUPATIONAL SAFETY

BACHELOR ACADEMIC STUDIES

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

STUDY PROGRAMME OBJECTIVES

Objectives of the bachelor academic studies study programme **Occupational 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 in the field of occupational safety engineering, to help them develop creative capabilities of acquiring practical skills to identify, analyze, and assess occupational risk and apply scientific and professional achievements from this field.

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

- Occupational hazard and risk identification;
- Use of preliminary risk analysis methods;
- Organization of risk assessment activities;
- Management of activities for facility, machinery, and equipment maintenance;
- Understanding of management system requirements and their implementation and integration;
- Employee education and training for occupational safety; and
- Organization and management of the safety system in organizations and local communities.

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

Overview of general and course-specific student competences:

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

- Identification of problems in the work environment and prediction of possible consequences;

- Mastering of methods, procedures, and processes of identification, analysis, and assessment of professional risk in the work environment;
- Development of critical thinking and approach to problems;
- Practical application of knowledge;
- Development of communication skills in the immediate and broader surrounding;
- Development of professional ethics.

Overview of the learning outcomes:

Upon completion of the study programme, students become professionally competent to:

- apply methods and procedures of preliminary occupational risk analysis;
- organize and conduct occupational risk assessment activities;
- measure and control the state of the work environment;
- maintain the quality of the work environment;
- record, analyze, and interpret data on injuries, diseases, property damage, effects on the work environment, and risks;
- implement, document, and control the requirements of the occupational safety and health system and the occupational safety management system;
- organize and conduct the integration of the management system;
- educate, train in, and nurture occupational safety and health culture;
- understand and apply the paradigm of sustainable development and economic principles of occupational safety;
- understand the ethical issues of occupational safety;
- manage occupational safety systems in organizations and local communities;
- use information and communication technology to stay up to date with the professional developments, to acquire new knowledge, and to solve occupational safety problems.

Bachelor engineers of occupational 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 **Occupational Safety** is to educate students to become bachelor engineers of occupational safety, which is in keeping with the needs and the development concept of the economy and society for the purpose of resolving complex issues in the work environment.

The Faculty of Occupational Safety defined the education of highly competent personnel in the field of occupational safety as one of its fundamental tasks and goals, in accordance with the faculty vision, mission, policy, and quality strategy.

The content of the Occupational 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, social sciences and humanities, and medical sciences, and acquire skills and competences that will enable them to work on complex and multidisciplinary occupational 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, occupational medicine, and education. The programme teaches students to: perform systems analysis of occupational problems; understand occupational processes and problems; record, analyze, and present data on the state of the work environment; understand the requirements of the occupational health and safety system and the occupational safety management system; understand the socio-economic principles of occupational safety and educational needs in occupational health and safety; and work as parts of a team.

In times of rapid technological development and progress, but also new potential hazards and risks (technological, professional, or environmental), 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 and propose a proper response and thus provide better living and working conditions, which makes this programme socially justified.

ADMISSION REQUIREMENTS

The Faculty of Occupational Safety in Niš enrolls 120 students in the first year of the bachelor academic studies study programme **Occupational 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' interests.

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

complaints about the preliminary ranking; and the tuition fee for self-financing students.

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

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

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

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

Candidates may file a complaint regarding any violation of the procedure established in the Competition rules, regarding any irregularity during the entrance exam, or regarding their ranking within 36 hours after the faculty has published the preliminary rankings. When a complaint has been filed, the faculty Dean has to settle the complaint within 24 hours. After every complaint has been handled, the Faculty of Occupational Safety in Niš determines and publishes the final rankings. Successful candidates may proceed with their enrolment only after the final rankings have been published.

Candidates may enrol as state-financed (or "budget") students if they rank within the approved number of students for state-paid tuition fee 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 fee 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 Occupational Safety (OS) 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 35.62 %;
- Professional-applicative 28.33 %.

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 21.51-21.55 (21.53 weekly average). The total number of lecture classes within the study programme is 87 (10.88 weekly average), the total number of exercise classes is 77 (9.62 weekly average), other forms of active classes 4.24 (0.53 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 occupational 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 the studies, students receive the academic degree

Bachelor with Honours in Occupational 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.	Ex.	Oth.	RS				
FIRST YEAR											
1.	19.OZNR01	Mathematics	1	3	3	0	0	0	6	R	AG
2.	19.OZNR02	Chemistry	1	3	2	0.67	0	0	6	R	AG
3.	19.OZNR03	Safety System Fundamentals	1	2	2	0	0	0	6	R	TM
4.	19.OZNR04	Sociology	1	2	2	0	0	0	6	R	AG
5.	19.OZNR05	Legal Fundamentals of Safety	1	2	2	0	0	0	6	R	SP
6.	19.OZNR06	Physics	2	3	2	0.67	0	0	6	R	AG
7.	19.OZNR07	Computer Science Fundamentals	2	2	1	0.53	0	0	6	R	AG
8.	19.OZNR08	Engineering Graphics	2	3	1	0.53	0	0	6	R	TM
9.	19.OZNR09	English Language	2	2	2	0	0	0	6	R	AG
10.	19.OZNR10	Safety Economics	2	2	2	0	0	0	6	R	TM
Total classes (lectures/exercises + other) and credits per year				24	19	2.40	0	0	60		
Total active classes per year				45.40				0	60		
SECOND YEAR											
11.	19.OZNR11	Electrotechnics Fundamentals	3	3	2	0	0	0	6	R	TM
12.	19.OZNR12	Mechanical Engineering Fundamentals	3	3	2	0	0	0	6	R	TM
13.	19.OZNR13	Technological Systems and Safety	3	2	2	0	0	0	6	R	SP
14.	19.OZNR14	Risk from Hazardous Materials	3	2	2	0	0	0	6	R	SP
15.	19.OZNR15	Systems and Risk Modelling	3	2	2	0.13	0	0	6	R	SP
16.	19.OZNR16	Chemical Parameters of Occupational and Environmental Quality	4	2	2	0.27	0	0	6	R	SP
17.	19.OZNR17	Thermodynamics and Thermotechnics	4	2	2	0	0	0	6	R	TM
18.	19.OZNR18	Technical Materials	4	2	2	0	0	0	6	R	TM
19.	19.OZNR19	Safety Statistics	4	2	2	0.27	0	0	6	R	TM
20.	19.OZNR20	Occupational and Environmental Quality Indicators	4	2	2	0	0	0	6	E	SP
	19.OZNR21	Fire and Explosions	4	2	2	0	0	0	6	E	SP
Total classes (lectures/exercises + other) and credits per year				22	20	0.67	0	0	60		
Total active classes per year				42.67				0	60		

#	Code	Course name	Term paper	Active classes				Oth.	ECTS	Required/ Elective (R/E)	Course type
				Le.	Ex.	Oth.	RS				
THIRD YEAR											
21.	19.OZNR22	Noise and Vibration	5	3	2	1	0	0	6	R	SP
22.	19.OZNR23	Electromagnetic Radiation	5	2	2	0	0	0	6	R	SP
23.	19.OZNR24	Toxicology	5	2	2	0	0	0	6	R	SP
24.	19.OZNR25	Ergonomics	5	2	2	0	0	0	6	E	SP
	19.OZNR26	Alarm Systems	5	2	2	0	0	0	6	E	PA
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.OZNR29	Machine and Device Safety	6	2	2	0	0	0	6	R	PA
27.	19.OZNR30	Electrical Hazards	6	2	2	1	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.OZNR32	Occupational Safety in Civil Engineering	6	2	2	0	0	0	6	R	PA
30.	19.OZNR33	Electrical Facilities and Installations	6	2	2	0	0	0	6	E	SP
	19.OZOP05	Fire Extinguishing Agents and Equipment	6	2	2	0	0	0	6	E	PA
Total classes (lectures/exercises + other) and credits per year				21	20	1.06	0	0	60		
Total active classes per year				42.06				0	60		
FOURTH YEAR											
31.	19.OZNR34	Internal Transportation Safety	7	2	2	0	0	0	6	R	SP
32.	19.OZNR35	Comfort in the Work Environment	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.OZNR39	Industrial Structures	7	2	2	0	0	0	5	E	PA
	19.OZZS10	Industrial Ecology	7	2	2	0	0	0	5	E	PA
36.	19.OZNR40	Internship	7	0	0	0	0	6	3	R	PA
37.	19.OZNR41	Professional Risk	8	3	2	0	0	0	6	R	PA
38.	19.OZNR42	Organization of Work and Occupational Safety	8	3	2	0	0	0	6	R	PA
39.	19.OZNR43	Technical System Maintenance	8	2	2	0	0	0	5	E	PA
	19.OZNR44	Industrial Waste Treatment	8	2	2	0	0	0	5	E	PA
40.	19.OZNR45	Psychophysiology of Work	8	2	2	0	0	0	5	E	SP
	19.OZNR46	Health Protection	8	2	2	0	0	0	5	E	TM
41.	19.ZNR47A	Diploma Thesis – Research	8	0	0	0	4	0	5	R	PA
42.	19.ZNR47B	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	0.00 - 0.27	4	8	60		
Total active classes per year	42.00-42.27				8	60		
Total active classes, other classes, and credits for all years	172.13-172.40				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. Noise and Vibration
21. Electromagnetic Radiation
22. Toxicology
23. Machine and Device Safety
24. Electrical Hazards
25. Theory and Organization of Safety Education
26. Occupational Safety in Civil Engineering
27. Internal Transportation Safety
28. Comfort in the Work Environment
29. Risk Assessment Methods
30. Internship
31. Professional Risk
32. Organization of Work and Occupational Safety
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: <ul style="list-style-type: none">• 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 <i>Mathematica</i> software package.									
Literature [1] Aleksić Violeta, Vidanović Mirjana, Stanković Miomir (2006). <i>Matematika, 1. deo, elementi teorije i zadaci sa rešenjima</i> . Niš: Univerzitet u Nišu, Fakultet zaštite na radu u Nišu [2] Aleksić Violeta, Vidanović Mirjana, Stanković Miomir (2006). <i>Matematika, 2. deo, elementi teorije i zadaci sa rešenjima</i> . Niš: Univerzitet u Nišu, Fakultet zaštite na radu u Nišu [3] Kečkić Jovan, Stanković Miomir (1981). <i>Matematika 1</i> . Niš: Univerzitet u Nišu [4] Pejović Tadija (1981). <i>Matematička analiza I</i> . Beograd: Naučna knjiga [5] Miličić Pavle, Momčilo Uščumlić (1996). <i>Zbirka zadataka iz više matematike I</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: <ul style="list-style-type: none"> • understand the structure of chemical substances and the chemical interactions influenced by them; • 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 a 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	-
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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: <ul style="list-style-type: none"> • 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 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). <i>Osnovi sistema zaštite</i> . Niš: Univerzitet u Nišu, Fakultet zaštite na radu u Nišu [2] Stanković Miomir, Savić Suzana, Anđelković Branislav (2002). <i>Sistemska analiza i teorija rizika</i> . 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: <ul style="list-style-type: none"> • 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	-
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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: <ul style="list-style-type: none">• 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: <ul style="list-style-type: none"> • 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	-
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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: <ul style="list-style-type: none"> • apply computer science and information technology for independently solving safety problems using computers; • understand the functioning of computer systems on the arithmetic and logical levels; • solve logical problems and employ abstract reasoning using logic circuits and logical laws; • algorithmically solve problems; • use software tools for text processing and tabular calculations on an advanced level. 		
Course outline Theoretical lessons Arithmetic basics of computers: Number systems and number bases. Data representation in computer memory. Two's complement and one's complement. Floating and non-floating points. Realization of arithmetic operations. Conversion of numbers using tables. Conversion of numbers using class methods. Representation of character data. Representation of logical data. Codes and coding. Logical basics of computers: Boolean logic. Elementary logical functions and elementary logic circuits. Additional logical functions and logic circuits. Logical identities. Normal and minimal forms of logical functions. Methods of minimizing logical functions. Adders. Architecture of personal computers: Computer model. Hierarchic structure of computer systems. Functional parts of computer systems and their characteristics. Hardware. Algorithmization: Basics of algorithmization. Algorithmic block. Algorithmic structures. Software: System software. Files. Hierarchic structure of files. Application software. Classification of application software.		
Practical lessons They are split into two parts, which follow the theoretical lessons. Auditory and calculation exercises focus on practical examples pertaining to arithmetic and logical fundamentals of computers and algorithmic structures. Students are asked to logically describe problems using logical functions. The second part involves the solving of elementary problems using application software. The acquired knowledge is applied through practical work in a computer laboratory, whereby individual problem-solving using application software is encouraged.		
Literature [1] Krstić Dejan, Blagojević Milan, Janačković Goran (2019). <i>Računarska tehnika- osnovi organizacije i primene personalnih računara</i> , 3. izdanje. Niš: Univerzitet u Nišu, Fakultet zaštite na radu u Nišu [2] Janačković Goran, Krstić Dejan, Zlatković Bojana (2015). <i>Zbirka zadataka iz računarske tehnike sa praktikumom</i> . 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: <ul style="list-style-type: none">• create graphic projections using modern software tools;• use, create, and amend technical documentation in traditional and modern formats.									
Course outline Theoretical lessons Descriptive geometry. Projection and types of projection. Single-plane projection. Two-plane projection. Three-plane projection. Point and its projection. Line and its projection. Plane and its projection. Interposition of point, line, and plane. Point and plane. Line and plane. Point and line. Transformation of a point. Transformation of a plane. Transformation of a shape. Rotation. Rotation of a point. Rotation of a line. Rotation of a shape. Shapes and their projections. Projection of polyhedrons. Pyramids. Prisms. Projection of round shapes. Circular cones. Circular cylinders. Plane sections of shapes and grids. Plane section and grid of a pyramid. Section of oblique pyramid and general plane. Section of oblique pyramid and special plane. Direct penetration method. Determination of 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). <i>Osnovi inženjerske grafike</i> . Niš: Univerzitet u Nišu, Fakultet zaštite na radu u Nišu [2.] Đurđanović Mihailo, Kulašević Dragan (2009). <i>Inženjerska grafika, Zbirka zadataka iz nacrtne geometrije</i> , Niš: Univerzitet u Nišu, Fakultet zaštite na radu u Nišu [3.] Đurđanović Mihailo, Mijailović Ivan (2010): <i>Inženjerska grafika, Zbirka zadataka iz tehničkog crtanja</i> . 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: <ul style="list-style-type: none"> • 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). <i>Environmental Science in English</i> . Niš: Univerzitet u Nišu, Fakultet zaštite na radu u Nišu [2.] Tošić Jelica (2009). <i>Environmental Science Dictionary</i> . 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 [4.] 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/document/s/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: <ul style="list-style-type: none">• assess occupational and environmental economic impact;• consider the economic effects of investing in safety;• manage projects of protection and 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 & Francis 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: <ul style="list-style-type: none"> • 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	-
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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: <ul style="list-style-type: none">• 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 are aimed at analyzing the laws of elementary machine elements' quiescence, stress state, and deformation state, as well as their sizing.									
Literature [1] Miltenović Vojislav (2009). <i>Mašinski elementi – oblici, proračun primena</i> . Niš: Univerzitet u Nišu, Mašinski fakultet [2] Mitić Slavka (2009). <i>Tehnička mehanika</i> . 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: <ul style="list-style-type: none"> • 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). <i>Tehnološki sistemi i zaštita</i> . Niš: Univerzitet u Nišu, Fakultet zaštite na radu u Nišu [2] Cvijović Svetomir, Bošković Nevenka, Pjanović Rada (2007). <i>Mehaničke operacije</i> . Beograd: Akademska misao [3] Cvijović Svetomir, Bošković Nevenka, Pjanović Rada (2007). <i>Toplotne operacije</i> . Beograd: Akademska misao [4] Cvijović Svetomir, Bošković Nevenka, Pjanović Rada (2007). <i>Difuzione operacije</i> . 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: <ul style="list-style-type: none"> • 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. Warning and notice signs. Hazmat labels/placards. Hazmat plates. Hazardous material handling: Production of hazardous materials. Packaging (labelling of packages and containers). Hazardous material manipulation. Storage and transport of hazardous materials (international agreements concerning transport of hazardous materials, labelling of vehicles for transport of hazardous materials). Explosive materials: Classification. Commercial explosives. Detonators. Risk from explosive materials. Effects of explosions and their products on humans and the environment. Production and manipulation. Hazmat labels/placards and plates. Transport of explosive materials. Compressed, liquefied, and dissolved gases: Classification. Risk, packaging, and storage of gases. Containers for compressed gases and dissolved gases. Labelling of gases, hazmat labels/placards and plates. Transport of gases. Flammable liquids: Mechanism of liquid combustion. Classification, risk, and hazard zones of fire breakout and propagation. Packaging and labelling of containers containing flammable liquids. Manipulation, storage, transport, and labelling of vehicles for transport of flammable liquids. Flammable solid materials: Mechanism of solid material combustion. Dust combustion. Classification of flammable solid materials. Spontaneously combustible materials. Materials which, in contact with water, emit flammable gases. Risk, packaging and storage of solid materials. Hazmat labels/placards and plates. Transport of solid materials. Oxidizing materials: Classification. Hazmat labels/placards and plates. Labelling of vehicles and transport. Organic peroxides: Classification. Hazmat labels/placards and plates. Labelling of vehicles and transport. Toxic materials: Classification. Hazmat labels/placards and plates. Labelling of vehicles and transport. Infectious materials: Classification. Hazmat labels/placards and plates. Labelling of vehicles and transport. Radioactive materials: Packaging and storage. Hazmat labels/placards. Corrosive materials: Packaging, storage. Hazmat labels/placards. Analysis and assessment of risk from hazardous materials: Data collection and processing. Exposure assessment. Harm and toxicity assessment. Risk characterization. Management of hazardous materials.		

Practical lessons

Calculation exercises: Calculation of properties of explosive and flammable materials.

Term papers: Presentation and defence of project assignments and term papers on a selected topic followed by a discussion.

Literature

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

Number of active classes (weekly)

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

Lectures (oral exposition, multimedia presentations, discussions), exercises (calculation problems, individual presentation of project assignments and term papers with 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 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 about their application in risk management.		
Course outcome Students' acquisition of skills and ability to: <ul style="list-style-type: none"> • 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). <i>Automatsko upravljanje</i> . Niš: Univerzitet u Nišu, Prirodno-matematički fakultet [2] Janačković Goran, Zlatković Bojana (2018). <i>Zbirka zadataka iz teorije sistema i rizika</i> . 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	-
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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: <ul style="list-style-type: none"> 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	-
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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: <ul style="list-style-type: none"> • calculate thermodynamic state and process functions of an ideal gas and gas mixtures; • interpret the first and second laws of thermodynamics, thermodynamic cycle, thermodynamic efficiency, and the basics of real gases and vapours; • calculate the quantities of heat transfer, conduction, convection, and radiation through flat, cylindrical, and spherical surfaces, and calculate the basic parameters of heat exchanger mass and energy balance; • describe the operating principles of boilers, chimneys, chillers, and heat pumps and the basics of combustion; • analyze hazards during work with thermotechnical devices and understand the role of measurement, control, and protective equipment. 		
Course outline Theoretical lessons Fundamentals of thermodynamics: Thermodynamic system and the surrounding. Working substance. State functions. Thermodynamic equilibrium. Zeroth law of thermodynamics. Gas laws. Equation of state for an ideal gas. Mixture of ideal gases. Molar mass and gas constant of a mixture. Partial pressures of components. Relationships between mixture components. Working substance energy: Internal energy. Quantity of heat. Heat capacity. Mayer's equation. Dependence of heat capacity on temperature. Heat capacity of a gas mixture. First law of thermodynamics: Change of state, state of equilibrium and non-equilibrium. Work PV diagram, reversible and irreversible processes. Definition and mathematical expression of the first law of thermodynamics. General polytropic change of state equation. Special cases of change of state. Quantity of heat and work during the change of state of an ideal gas. Relationship between quantity of heat and work with the change of ideal gas temperature, damping process and enthalpy. Second law of thermodynamics: Definition of the second law of thermodynamics. Cyclic processes. Right-going and left-going cyclic processes. Properties of state functions and change of state functions. Mathematical expression of the second law of thermodynamics. Entropy. T-s diagram. Thermodynamic efficiency. Carnot's cycle. Cycles: <i>Joule-Brayton, Otto, Diesel, Sabathe</i> . 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	-
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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' <ul style="list-style-type: none"> • 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). <i>Tehnički materijali</i> . Niš: Univerzitet u Nišu, Fakultet zaštite na radu u Nišu [2] Callister William, Rethwisch David (2007). <i>Materials science and engineering: an introduction</i> . John Wiley & Sons [3] Ashby Michael, Shercliff Hugh, Cebon David (2018). <i>Materials: engineering, science, processing and design</i> . Butterworth-Heinemann [4] Askeland Donald, Wright Wendelin (2013). <i>Essentials of materials science & engineering</i> . 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: <ul style="list-style-type: none">• 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^2 -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). <i>Statistika za studente geografije</i> . Niš: Univerzitet u Nišu, Prirodno-matematički fakultet [2] Popović Biljana, Ristić Miroslav (2001). <i>Statistika u psihologiji</i> . Beograd: Mrlješ [3] Popović Biljana, Ristić Miodrag (2001). <i>Statistika u psihologiji - dodatak</i> . Beograd: Mrlješ [4] Đolović Ivana (2011). <i>Zbirka zadataka iz statistike</i> . 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: Noise and Vibration		
Course status: Required	Course code:	19.OZNR22
ECTS credits: 6		
Requirements: -		
Course aim Acquisition of theoretical and practical knowledge and ability to: <ul style="list-style-type: none"> • identify and understand the principles and occurrences of noise and vibration, which provides a foundation for proper application of the theoretical framework, software tools, and experimental techniques; • identify and understand human reactions to occupational noise and vibration and their impact on the human body, as well as to apply this knowledge to solving practical problems in occupational safety engineering. 		
Course outcome Students' acquisition of skills and ability to: <ul style="list-style-type: none"> • identify and explore practical problems pertaining to noise and vibration; • identify occurrences and sources of noise and vibration and evaluate them based on measurements; • select and apply measures for solving the problems of occupational noise and vibration; • understand human reactions to vibration that is transmitted over the whole body and the hand-arm system and to understand human reactions to occupational noise; • identify, select, and practically apply proper standards, recommendations, and regulations concerning the work environment, as well as practical measures of occupational safety of people. 		
Course outline Theoretical lessons Physical concept of sound: Generation of sound. Functions of sound. Definitions of sound and noise. Propagation of sound. Types of sound waves. Sound wave quantities. Phenomena accompanying sound wave propagation. Acoustic energy quantities: Sound energy. Sound energy density. Sound intensity. Sound power. Point sources of sound: Model of a sound point source. Sound sources with non-directional and directional radiation. Spatial angle of radiation. Combined effect of independent sound sources (simple and complex sound). Sound source next to an obstacle. Perception of sound: Definition of perception. Organ of hearing – outer, middle, and inner ear. Sound transmission. Distribution of sound energy along the basilar membrane. Hearing frequency range. Dynamic range of hearing. Objective quantities for describing sound intensity: Reason for using sound levels. Definition of sound levels. Decibel scale. Change of sound level. Resulting level of complex sound. Sound level of a specific sound source. Subjective quantities for describing sound intensity: Subjective sound intensity. Loudness. Frequency weighting curves: A and C curves. Subjective energy quantities: Equivalent noise level. Level of exposure to sound. Acoustics of enclosed areas: Mathematical models of sound field. Sound absorption coefficient. Statistical theory of sound field. Reverberation time. Areas with a high sound absorption coefficient. Sound isolation: Processes during sound wave contact with a partition. Sound transmission class. Isolation capacity of a partition. Sound isolation of a room. Types of noise: Characteristics of noise. Types of noise according to the temporal nature of noise. Types of noise according to the frequency nature of noise. Types of noise according to the scope of noise sources. Structure of noise measurement instruments and measurement quantities: Structure of noise measurement		

instruments. Condenser microphones. Band and narrow-band frequency analysis of noise signal. Noise signal detector. Measurement quantities. **Measurement of occupational noise:** Origin of occupational noise. Quantities for assessing worker exposure to noise. Standards and regulations for occupational noise measurement. Methodology of measurement and calculation of quantities for worker noise exposure assessment. Allowed occupational noise levels. **Health effects of noise:** Auditory effects of noise. Extra-auditory effects of noise. Personal protective equipment for noise protection.

Physical concept of vibration: Definition of vibration. Sources of vibration. Mechanical system components. Forces accompanying vibration. Generation of vibration. Classes of vibration. Basic quantities of vibration. Vibration level. Basic descriptors of vibration signals. Types of vibration. Vibrational degrees of freedom. Harmonic and non-harmonic vibration. Coupling of collinear synchronous and asynchronous vibrations. **Evaluation of vibration transmitted through the human body during work:** Human body and vibration. Transmission of vibration through the human body. Evaluation of vibration transmitted through the human body. **Structure of vibration measurement instruments and measurement quantities:** Structure of instruments for measuring. Accelerometers – operating principles and setup. Frequency weighting curves. Measurement quantities. **Measurement and effects of vibration transmitted through the human body during work:** Standards and regulations for occupational vibration measurement. Procedure for measuring vibration transmitted through the human body. **Effects of vibration on the human body – vibration-related diseases:** Personal protective equipment for vibration protection.

Practical lessons – calculation exercises and laboratory work

Calculation exercises and laboratory work thematically follow the theoretical lessons, contribute to a better understanding of the course materials, and complement students' knowledge.

CALCULATION EXERCISES:

- Calculation of different acoustic quantities under specific operating conditions of noise sources: sound pressure, sound power, sound intensity, sound level, subjective sound intensity, loudness, equivalent noise level, sound exposure level, sound absorption coefficient, absorbing surface of the room, room reverberation time, room sound isolation;
- Coupling of collinear synchronous and asynchronous vibrations;
- Calculation of daily exposure to vibration for cases of vibration transmission to workers via the hand-arm system and the whole body and assessment of the state of vibration exposure in relation to the prescribed action values and limit values.

LABORATORY WORK:

1. Measurement of sound power of various sound sources;
2. Calculation of daily noise exposure of workers according to the results of noise level measurements;
3. Measurement of reverberation time and sound isolation of a room;
4. Calculation of daily vibration exposure of workers according to measurement results for vibration acceleration while handling hand tools and operating transport vehicles.

Literature

- [1] Cvetković Dragan, Prašćević Momir (2005). *Buka i vibracije*. Niš: Univerzitet u Nišu, Fakultet zaštite na radu u Nišu
- [2] Cvetković Dragan, Prašćević Momir (1999). *Buka i vibracije - zbirka zadataka sa teorijskim osnovama*. Niš: Izdavačka jedinica Univerziteta u Nišu

[3] Cvetković Dragan, Praščević Momir, Mihajlov Darko (2013). *Fizičke štetnosti - zbirka rešenih zadataka*. Niš: Univerzitet u Nišu, Fakultet zaštite na radu u Nišu

Number of active classes (weekly)

Lectures	3	Auditory exercises	2	Other forms of classes	1	RS	-	Other classes	-
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Teaching methods

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

Grading (maximum number of points: 100)

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

Course name: Electromagnetic Radiation		
Course status: Required	Course code:	19.OZNR23
ECTS credits: 6		
Requirements: -		
Course aim Acquisition of knowledge about the basic terms and laws of electromagnetism and electromagnetic wave and corpuscular radiation.		
Course outcome Students' ability to understand the phenomena and principles pertaining to: <ul style="list-style-type: none"> • electromagnetic fields and sources in the occupational environment; • electromagnetic waves and non-ionizing radiation; • optical quantum corpuscular radiation (UV, VIS, IR); • electromagnetic ionizing radiation; • effects and impact of all types of radiation on the material environment, particularly on people and their health. 		
Course outline Theoretical lessons: Electromagnetic (EM) fields: Introduction to physical quantities of field and energy. Physical interpretation of gradient, divergence, and rotor. Electrostatic polje. Electric induction vector. Third Maxwell's equation. Magnetic field. Magnetic induction flux. Fourth Maxwell's equation. Magnetic field in matter. Ampere's law generalization. Dielectric shift current. First Maxwell's equation. Electromagnetic induction. Faraday's law generalization. Second Maxwell's equation. Stationary electric field. Charge continuity equation. Ohm's law in local form. Complete system of equations of macroscopic EM field in stationary environments. Electromagnetic waves and electromagnetic radiation: Wave equation for potentials and transfer speed of EM disturbance. Solution of the wave equation, solution analysis, plane, cylindrical, and spherical waves. Simple periodical EM waves and Helmholtz equation. Helmholtz equation solution. EM wave properties in dielectrics, semi-conductive, conductive, and ionized environments. Reflection, transmission, and absorption of EM waves. Electromagnetic radiation: Electric dipole and an electric component of EM wave. Current element and magnetic component of EM wave. Hertzian dipole and dipole as a harmonic oscillator. Radiation zones and dipole radiation characteristics. Corpuscular quantum radiation: Optical radiation. Wave-quantum laws of radiation. IR radiation (thermal radiation). Corpuscular quantum motion in atoms. Thermal radiation laws. UV radiation. Visible radiation. Law of radioactive decay and absorption. Ionizing radiation. Effects of electromagnetic radiation on the material environment: Natural sources of electromagnetic radiation in the environment. Artificial sources of electromagnetic radiation. RF radiation. Laser radiation. From non-ionizing to ionizing radiation. Biological effects of EM field and EM radiation on humans. Principle of measurement and testing of EM radiation. Dosimetry of non-ionizing and ionizing radiation. Safety measures. Practical lessons Auditory exercises: Practical lessons comprise calculation exercises, which expand the units from theoretical lessons through solving calculation problems, improve students' understanding and their level of knowledge acquisition, thus providing them with complete theoretical and practical knowledge, and demonstrate the use of EM field measuring instruments.		

Literature

- [1] Petković Dejan, Krstić Dejan, Stanković Vladimir (2008). *Elektromagnetni talasi i zračenje* (Elektromagnetna zračenja – Izvodi sa predavanja i vežbi - Sveska 5). Niš: Univerzitet u Nišu, Fakultet zaštite na radu u Nišu
- [2] Krstić Dejan (2020). *Elektromagnetna zračenja u životnoj sredini*. Niš: Univerzitet u Nišu, Fakultet zaštite na radu
- [3] Veličković Dragan (1997). *Elektromagnetna zračenja*. Niš
- [4] Petković Dejan (2016). *Elektromagnetizam* (Elektromagnetna zračenja – Izvodi sa predavanja i vežbi – Sveska 3). Niš: Univerzitet u Nišu, Fakultet zaštite na radu u Nišu
- [5] Popović Đ. Branko (1965). *Zbornik rešenih problema iz elektromagnetike*. Beograd. Građevinska knjiga

Number of active classes (weekly)

Lectures	2	Auditory exercises	2	Other forms of classes	-	RS	-	Other classes	-
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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)	15
Activity during exercises	5	Oral exam (theoretical part of the exam)	25
Colloquium 1	25		
Colloquium 2	25		

Course name: Toxicology		
Course status: Required	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 risks and hazards and proposing preventive and protective measures.		
Course outcome Students' acquisition of skills and ability to: <ul style="list-style-type: none"> • 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: <i>In vivo</i> , <i>in vitro</i> , <i>in silico</i> 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). <i>Toksikologija – interni materijal za pripremu ispita</i> . Niš: Univerzitet u Nišu, Fakultet zaštite na radu u Nišu [2] Jokanović Milan (2001). <i>Toksikologija</i> . Beograd: Elit Medika [3] Vitorović Slavoljub, Milošević Milenko (2002). <i>Osnovi toksikologije sa elementima ekotoksikologije</i> . Beograd: Vizartis [4] Klaassen Curtis (2013). <i>Casarett & Doull's Toxicology: The Basic Science of Poisons</i> . 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	-
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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: Machine and Device Safety		
Course status: Required	Course code:	19.OZNR29
ECTS credits: 6		
Requirements: -		
Course aim Acquisition of knowledge about processes, development, construction, and use of safety systems for various machines and devices.		
Course outcome Students' acquisition of skills and ability regarding: <ul style="list-style-type: none"> • the use of technical solutions for machine safety; • the requirements for safety system installation; • design principles; • the assessment of risk to machine operators. 		
Course outline Theoretical lessons Development of machine and device safety system. Characteristics of machine hazards (analysis of machine and device hazardous zones). Safety modes and requirements for safety system installation in machines and devices (safety devices, blocking devices, and safety armours). Constructive solutions for machine safety systems with manual insertion and removal of processed items. Important requirements for machine design and construction (safety of operating systems, protection from mechanical hazards). Risk assessment for machine operators and risk reduction through adequate construction. Machinery directive and machine safety standards. Safety systems on cutting machines: lathes, planers, drills, mills, and sanders. Machine risk level analysis: example of a sander. Safety systems on wood processing machines: band saws, circular saws, planers, mills, and sanders. Safety systems on machines for primary and secondary processing of wood. Safety systems on deformation-processing machines: mechanical and hydraulic presses. Safety device systems on various machines. Safety requirements for machine construction (closed-tool construction, movement blocking system for central executive mechanism, etc.). Safety system on machines with two-hand controls: installation requirements, activation principles, place of installation, safety conditions. Safety light curtain systems: types, installation, operating principle, construction. Safety system created through adequate construction of operating devices, commands, gadgets, blockings, control instruments, and signalling devices. Declaration of Conformity. Technical documentation for machines, CE marking. Conformity evaluation procedure. Practical lessons Introduction to principles of constructive machine safety solutions and methods of controlling and testing machine and device safety functions. Inspection and testing of work equipment and provision of professional opinion regarding safety. Instructions for proper use, maintenance, and safe operation.		
Literature [1.] Janković Žarko (1999). <i>Sistemi zaštite na mašinama – koncepcijska analiza</i> . Niš: Univerzitet u Nišu, Fakultet zaštite na radu u Nišu [2.] Janković Žarko (2012). <i>Tehnički sistemi zaštita II</i> . 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 (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				15					
Term paper				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: <ul style="list-style-type: none"> • 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 overheating. 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	-
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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 <ul style="list-style-type: none"> • 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 plans 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	-
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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: Occupational Safety in Civil Engineering		
Course status: Required	Course code:	19.OZNR32
ECTS credits: 6		
Requirements: -		
Course aim Acquisition of knowledge about occupational safety and health during work in building construction, hydraulic engineering, and heavy engineering.		
Course outcome Students' ability to: <ul style="list-style-type: none"> • identify hazards and harms; • plan and implement occupational safety and health measures during construction work. 		
Course outline Theoretical lessons Civil engineering structures and their classification: Building construction, heavy civil engineering, and hydraulic engineering structures. Construction work phases: Preparation work. Basic construction work. Installation work. Finishing work. Classification of construction work and safety measures during work performance: Earthworks (excavation, trenches, pits, etc.). Masonry work (work at height, work on roofs, construction of smokestacks, etc.). Reinforcement work. Concrete work. Carpentry work. Prefabricated construction. Building demolition. Road construction. Bridge construction. Caissons. Pile driving. Installation of precast concrete girders. Tunnelling work. Blasting work. Hazards and harms during construction work and proper safety measures: Mechanical hazards, electrical hazard. Fire and explosion hazards, thermal hazards. Extreme temperatures. Chemical harms. Noise and vibration. Unfavourable microclimate conditions. Insufficient workplace lighting. Disposal of municipal and hazardous waste at the construction site and other unfavourable work environment factors. Personal protective equipment of construction workers. Organization of construction sites and occupational safety measures: Protection from falling over edges and into holes. Protective scaffolding. Protective barriers. Protective measures for workers' movement at the construction site. Construction machinery and safety measures: Excavators, cranes, transport equipment, etc. Practical lessons Auditory exercises follow the theoretical lessons and include the presentation and defence of the term paper on construction site organization through analysis of how construction work and personal protective equipment are organized in terms of occupational safety and health.		
Literature [1] Ćirović Goran, Lazić Vojinović Slavka (2009). <i>Bezbednost i zaštita zdravlja na radu u građevinarstvu</i> . Beograd: AGM knjiga [2] Hughes Phil, Ferrett Ed (2007). <i>Introduction to Health and Safety in Construction</i> . USA: Elsevier [3] Reese D. Charls, Eidons V. James (2006). <i>Handbook of OSHA Construction Safety and Health</i> . USA: Taylor & Francis Group [4] Zou X.W. Patrick, Sunindijo Riza Yosia (2015). <i>Strategic Safety Management in Construction and Engineering</i> . USA: Wiley Blackwell [5] Man Li Rita Yi, Poon Sun Wah (2013). <i>Construction Safety</i> . Verlag Berlin Heidelberg: Springer		

Number of active classes (weekly)									
Lectures	2	Auditory exercises	2	Other forms of classes	-	RS	-	Other classes	-
Teaching methods									
Lectures, discussions, auditory exercises, term papers, office hours									
Grading (maximum number of points: 100)									
Pre-exam requirements			Points	Exam				Points	
Activity during lectures			5	Written exam (practical part of the exam)				40	
Activity during exercises			5						
Colloquium 1			15						
Colloquium 2			15						
Term paper			20						

Course name: Internal Transportation Safety									
Course status: Required					Course code:		19.OZNR34		
ECTS credits: 5									
Requirements: -									
Course aim Acquisition of theoretical knowledge about transport equipment and hazards originating from them, about safety systems in transport equipment, and their optimal utilization, with special emphasis on transport logistics.									
Course outcome Students' acquisition of skills and ability to: <ul style="list-style-type: none">independently organize a safety system and logistics for transport equipment and optimally utilize transport;perform periodical inspections and controls of internal transportation equipment;write professional reports on transport equipment inspection;train employees for safe and healthy work with internal transportation equipment.									
Course outline Theoretical lessons Transport. Types of transport. Classification of material handling transport equipment. Discontinuous internal transportation equipment. Forklifts. Bridge cranes. Jib cranes. Vehicle-mounted cranes with a lifting platform. Vehicle-mounted hydraulic boom cranes. Vehicle-mounted hydraulic lever cranes. Continuous internal transportation equipment. Elevators. Conveyor systems. Belt conveyors. Construction machinery. Logistics. Logistical functions. Storage. Classification of storage areas. Material handling in warehouses. High-bay warehouses. Practical lessons Learning about regulations and methodologies for inspection and control of internal transportation equipment. Inspection and control of internal transportation equipment and provision of professional opinion regarding safety. Instructions for use, maintenance, and safe operation.									
Literature [1] Mijailović Ivan (2019). <i>Zaštita pri unutrašnjem transportu – interni materijal za pripremu ispita</i> . Niš: Univerzitet u Nišu, Fakultet zaštite na radu u Nišu [2] Bloomberg J. David, LeMay A. Stephen, Hanna B. Joe (2002). <i>Logistics</i> . Prentice Hall, New Jersey, USA [3] Naylor John (2002). <i>Introduction to the operations management</i> , Prentice Hall, New Jersey [4] Vogt John, Pienaar Wessel, Wit de Piet (2002). <i>Business logistic management - theory and practice</i> , Oxford university press									
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			25						
Colloquium 2			25						

Course name: Comfort in the Work Environment		
Course status: Required	Course code:	19.OZNR35
ECTS credits: 5		
Requirements: -		
Course aim Acquisition of knowledge for solving specific problems of microclimatic comfort in the work environment. Understanding of the human body and environmental heat and material balance, conditions of thermal and visual comfort in the work environment, hazards, harms, and implementation of safety measures. Understanding how the HVAC system operates to achieve thermal comfort in the work environment.		
Course outcome Students' ability to: <ul style="list-style-type: none"> • solve microclimatic parameters in the work environment and describe the heat balance of the human body interacting with the work environment; • calculate indicators of thermal comfort in the work environment with elements of workers' health impact assessment; • calculate basic parameters and select HVAC system elements; • calculate material and energy balance and parameters of changes in humid air states during the winter and summer operating regimens of air conditioners; • grasp visual comfort and be able to assess the quality of indoor lighting; • independently measure microclimatic conditions and illumination in the work environment. 		
Course outline Theoretical lessons Thermal comfort: Definition of thermal comfort. Microclimatic parameters in a space. Effective temperature. Thermal properties of human body, heat balance, regulation of body temperature. Heat exchange between a human body and the environment. Thermal stress. Influence of high and low temperatures on the feeling of comfort in the work environment. Low and high indoor air humidity and the feeling of comfort. Indoor air flow, heat radiation, hygienic and sanitary requirements for comfort, work under high- and low-pressure conditions, indicators of thermal comfort. Determination and estimation of thermal comfort in the work environment. Means and methods for providing indoor comfort – basics of heating technology: classification and elements of heating systems, heat sources, heating bodies, ducting and armature. Basics of central heating system calculation, hazards and safety measures. Means and methods for providing indoor comfort – basics of ventilation technology: Principles of air circulation. General and local ventilation. Ventilation for comfort in the work environment. Characteristics of ventilation in the work environment. Basics of ventilation system calculation. Ventilation system elements. Ventilators. Hazards, harms, and safety measures. Means and methods for providing indoor comfort – basics of air conditioning technology: Humid air (thermodynamic properties), I-X diagram for humid air, quantities of humid air states. Air processing for the purpose of air conditioning. Heat losses and gains in air-conditioned spaces. Types of air-conditioning systems. Elements of air-conditioning systems. Hazards, harms, and safety measures. Air processing during winter and summer. Basics of calculating air-conditioning installations. Metering and regulating equipment, safety equipment. Lighting: Visual comfort. Natural and artificial lighting of workspaces and storage spaces. Quality of indoor lighting. Hazards, harms, and safety measures.		

Practical lessons

Calculation exercises that follow the theoretical lessons, project assignment, and term paper

Literature

- [1] Zrnić Slobodan, Ćulum Živojin (1991). *Grejanje i klimatizacija*. Beograd: RSO Naučna knjiga
- [2] Ken Parsons (2002). *Human Thermal Environments*, CRC Press, Taylor & Francis Group
- [3] Nedeljković Velimir, Raos Miomir (2005). *Klimatizacija - zbirka rešenih ispitnih zadataka*. Niš: Univerzitet u Nišu, Fakultet zaštite na radu u Nišu
- [4] Stefanović Velimir (2011). *Grejanje, toplifikacija i snabdevanje gasom*, Niš: Univerzitet u Nišu, Mašinski fakultet u Nišu
- [5] Kostić Miomir (2000). *Vodič kroz svet tehnike osvetljenja*. Beograd: Minel-Schreder

Number of active classes (weekly)

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

Lectures, calculation and 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)	20
Activity during exercises	5	Oral exam (theoretical part of the exam)	20
Colloquium 1	20		
Term paper 1	10		
Project assignment	20		

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: <ul style="list-style-type: none"> • 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). <i>Risk Assessment Methods</i> . Monograph. Nis: University of Nis, Faculty of Occupational Safety (in Serbian). [2] Rausand Marvin (2011). <i>Risk Assessment: Theory, Methods, and Applications</i> . New Jersey: John Wiley & Sons Inc. [3] Janković A. et al. (2009). <i>Occupational Safety and Health, Book 1</i> . Kragujevac-Novi Sad: University of Kragujevac, Faculty of Mechanical Engineering (in Serbian). [4] Sonnemann Guido, Castells Francesc, Schuhmacher Marta (2004). <i>Integrated Life-Cycle and Risk Assessment for Industrial Processes</i> . Boca Raton, London, New York, Washington D.C.: CRC Press LLC, Lewis Publishers. [5] Harms-Ringdahl Lars (2001). <i>Safety Analysis-Principles and Practice in Occupational Safety</i> . 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.OZNR40
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: <ul style="list-style-type: none"> • 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 of Environmental and Occupational Engineering within the selected company or institution; • understand the role of a bachelor with honours in occupational safety engineering, environmental engineering, and disaster and fire safety engineering within the organizational structure of a company or institution; • develop responsibility, professional work approach, and team communication skills; • use experiences of other professionals employed at the institution of the internship in order to expand their practical knowledge and increase their motivation. 		
Course outline Internship content is fully compliant with internship aims and is created specifically for each student, according to the activity of the company (institution) where the internship is done and according to the demands of the profession for which a student is educated. Students become familiar with the structure of the company (institution) and its operation objectives, adapt their own involvement to the study programme they chose, and regularly fulfil their work duties, which correspond to the duties of regular employees of the company (institution). Students provide an account of their involvement during the internship and critically reflect upon their experience and the knowledge and skills they acquired during the internship. As a rule, students choose a company (institution) from the government, private, or public sector for their internship. The internship may be done in institutions within Serbia that have a written agreement with the Faculty of Occupational Safety or that give consent for accepting student interns. At a student's proposal, the vice dean for education approves the internship at a chosen company (institution) and then issues the written internship order form. Based on the internship logbook, which needs to record at least 90 internship classes, and the certificate of internship signed by the authorized person and stamped with the company (institution) seal, confirming that the internship has been completed, the student is awarded 3 ECTS after the internship defence before the professors appointed for the defence by the Teaching and Scientific Council of the faculty.		

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

Course name: Professional Risk									
Course status: Required						Course code:		19.OZNR41	
ECTS credits: 6									
Requirements: -									
Course aim Acquisition of knowledge about procedures and organization of professional risk assessment in the workplace and in the work environment.									
Course outcome Students' acquisition of skills and ability to: <ul style="list-style-type: none">• identify hazards and harms in the workplace and in the work environment;• understand, organize, and implement professional risk assessment procedures;• implement measures to reduce professional risk.									
Course outline Theoretical lessons Professional risk – definition, subject matter, and goal: Definition of professional risk. System risk. Accident. Occupational injury. Theories of occupational accidents and injuries. Causes of accidents and injuries. Work-related disease. Professional disease. Professional risk legislation: International legislation. National legislation. Professional risk assessment: Mathematical formulation of professional risk. Methodological procedure of professional risk assessment. Legal basis for risk assessment. Analysis of occupational diseases and injuries. Recording of work organization. Identification and determination of hazards and/or harms. Risk assessment. Professional risk reduction measures: Preventive measures for safe and healthy work in the workplace. Personal protective equipment. Inspection and control of work equipment and examination of conditions in the work environment. Occupational safety and health record keeping. Occupational safety and health measures during provision of first aid. Provision of occupational safety and health labels. Standardization regulations for professional risk: Main elements of the ISO 45001 standard. Practical lessons Auditory/calculation exercises that successively follow the theoretical lessons and involve the analysis of practical examples of professional risk assessment in the workplace and the work environment. Presentation of term papers on a topic concerning professional risk assessment. Students are encouraged to conduct research in industrial practice.									
Literature [1] Krstić Ivan, Anđelković Branislav (2013). <i>Profesionalni rizik</i> . Niš: Univerzitet u Nišu, Fakultet zaštite na radu u Nišu [2] Anđelković Branislav (2002). <i>Rizik tehnoloških sistema i profesionalni rizik</i> . Niš: Jugoslovenski savez društava inženjera i tehničara zaštite [3] Borjanović Srđan (2008). <i>Metod za procenu rizika na radnom mestu i u radnoj okolini</i> . Beograd: Institut za medicinu rada Srbije "Dr Dragomir Karajović" [4] Jocić Neda (2008). <i>Vodič za procenu i upravljanje rizikom</i> . Petrovaradin: Futura doo									
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	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: Organization of Work and Occupational Safety		
Course status: Required	Course code:	19.OZNR42
ECTS credits: 6		
Requirements: -		
Course aim Acquisition of knowledge about organizational structure and functions of organizations, i.e. companies, and about the importance of organization of work and occupational safety in a business system.		
Course outcome Students' acquisition of skills and ability to: <ul style="list-style-type: none"> • organize work and occupational safety in a company; • motivate employees to implement occupational safety and health measures; • recognize the importance of safety culture. 		
Course outline Theoretical lessons Theories of organization: Definition of organization. Subject matter of organization studies. Managers and their roles in an organization. Human behaviour in an organization and organizational changes. Individual differences between people in an organization. Occupational safety: Definition and content of occupational safety and health. Role and importance of occupational safety and health. Obligations and responsibilities of employers. Risk assessment. Professional training of employees. Records. Rights and obligations of employees. Role and importance of persons in charge of occupational safety and health: Occupational safety management. State and problems of occupational safety and health. Organization of occupational safety and health jobs. Organization of work and occupational safety. Occupational safety and health system in Serbia. Motivation for occupational safety: Work motivation. Theories of work motivation. Personality and work motivation. Content theories of work motivation. Process theories of work motivation. How to motivate employees? Perception, learning, and motivation of employees. Interaction in a business system: Groups and teams. Group relations. Group processes. Leadership, power, and conflicts. Communication and decision making. Safety culture.		
Practical lessons Auditory exercises that follow the theoretical lessons. Presentation and defence of term papers. Analysis of practical examples pertaining to organization and management of the occupational safety system.		
Literature [1] Petković Mirjana, Janićijević Nebojša, Bogićević Milikić Biljana, Aleksić Mirić Ana (2014). <i>Organizacija</i> . Beograd: Centar za izdavačku delatnost Ekonomskog fakulteta u Beogradu [2] Živković Snežana (2008). <i>Teorija organizacije</i> , prevod sa ruskog, eksterni udžbenik, Niš: Fakultet zaštite na radu u Nišu [3] Živković Snežana (2008). <i>Motivacija za zaštitu na radu</i> . Niš: Fakultet zaštite na radu u Nišu [4] Živković Snežana (2011). <i>Uloga i značaj lica za bezbednost i zdravlje na radu u privrednim društvima u Srbiji</i> . Niš: 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									
Oral exposition (lectures), 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: Diploma Thesis – Research		
Course status: Required	Course code:	19.ZNR47A
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: <ul style="list-style-type: none"> • independently formulate and analyze problems and critically examine potential solutions; • independently apply previously acquired knowledge from the various fields they studied in order to examine the structure of a given research problem, as well as to apply systems analysis in order to draw conclusions about the possible ways of solving the given research problem; • independently use literature, thus expanding their knowledge by studying different methods and publications that deal with similar issues; • analyze and identify problems within a given topic and propose the ways to solve them; • consider the place and role of engineers in their chosen field; • develop team spirit and team work; • apply acquired engineering knowledge and skills to solve problems in practice; • stay up to date with and utilize new developments in their profession. 		
Course outline According to their preferences and affinity, students choose their research study area, specifically the course within which they will conduct their research associated with their previously approved topic of the diploma thesis. The mentor defines the research study task according to the requirements, complexity, and structure of specific research. Students study the problem and its structure and complexity, and study professional literature, including scientific and professional publications dealing with the given or similar topic; after analyzing the literature, they draw conclusions about potential problem solutions. By examining the literature, students learn about the methods used to solve similar problems and about the previous engineering practice regarding problem solutions. The research study also requires students to stay up to date with primary knowledge, to organize and conduct experiments and numerical simulations, to process data statistically, and to write a research paper from the narrow scientific field of their research study topic. The mentor evaluates the research study based on a student's defence of the research paper and approves the writing of the diploma thesis, which includes the results of the research study.		

Literature							
Number of active classes (weekly)							
Lectures	-	Auditory exercises	-	Other forms of classes	RS	4	Other classes
Teaching methods							
With the mentor's aid, students independently solve a given problem and research the subject matter, after which they write a research paper.							
Grading (maximum number of points: 100)							
Pre-exam requirements				Points	Exam		Points
Research paper – writing				50	Research paper – defence		50

Course name: Diploma Thesis – Writing and Defence							
Course status: Required		Course code:		19.ZNR47B			
ECTS credits: 3							
Requirements: Completion of exams for all courses in the study programme							
Course aim Combination of the theoretical background and the research study to solve a specific problem, for the purpose of examining the structure and performing a systems analysis of the problem in order to draw conclusions about the possible ways of solving it. Gaining experience of presenting the results of the research study in written form and orally, during the diploma thesis defence.							
Course outcome Students' ability to: <ul style="list-style-type: none">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. Ergonomics
4. Alarm Systems
5. Industrial Ventilation
6. Pressurized Facilities and Installations
7. Electrical Facilities and Installations
8. Fire Extinguishing Agents and Equipment
9. Safety Application of Information Technology
10. Integrated Management Systems
11. Industrial Structures
12. Industrial Ecology
13. Technical System Maintenance
14. Industrial Waste Treatment
15. Psychophysiology of Work
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: <ul style="list-style-type: none">• understand the methodology of the National List of Indicators;• analyze and create environmental quality indicators;• analyze and create work environment quality indicators;• analyze and create fire indicators;• create sets of indicators depending on the identified problems.									
Course outline Theoretical lessons Definition of indicators. Classification of indicators. Social and economic indicators. Indicators of the state of the work environment: Definition and classification. Number of occupational injuries and number of fatal occupational injuries. Index of occupational injury frequency. Index of occupational injury severity. Disability index. Indicators of the state of fires and explosions: Definition and classification. Number of fires in terms of the population number. Number of fatalities per fire. Chain base index. Indicators of the state of the natural environment: Definition and classification. Indicators of pollution sources. Impact indicators. Air and climate change indicators. Water indicators. Soil indicators. Natural and biological diversity indicators. Energy indicators. Agricultural indicators. Transport indicators. Tourism indicators. Noise indicators. Radiation indicators. Urbanization indicators. Indicators of international and national legislation. Indicators of subjects of the environmental protection system and of environmental elements' quality. Indicators of sustainable development. Indicators of sustainable energy development. Indicators of sustainable industrial development. Procedure of indicator selection. Ranking of indicators. Sets of sustainable development indicators. Practical lessons Exercises follow the theoretical lessons, with problem solving and defence of term papers.									
Literature [1] Malenović Nikolić Jelena (2020). <i>Indikatori kvaliteta radne i životne sredine (interni materijal za pripremu ispita)</i> . Niš: Univerzitet u Nišu, Fakultet zaštite na radu u Nišu [2] Malenović Nikolić Jelena (2019). <i>Indikatori kvaliteta radne i životne sredine (praktikum)</i> . Niš: Univerzitet u Nišu, Fakultet zaštite na radu u Nišu [3] Agencija za zaštitu životne sredine (2007). <i>Indikatori životne sredine u Republici Srbiji</i> . Beograd: Ministarstvo životne sredine [4] <i>Nacionalna lista indikatora životne sredine</i> (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: <ul style="list-style-type: none"> • 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	0	RS	-	Other classes	-
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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: Ergonomics									
Course status: Elective						Course code:		19.OZNR25	
ECTS credits: 6									
Requirements: -									
Course aim Acquisition of knowledge about basic ergonomic principles for work conditions analysis and redesign and use of information (anatomic, physiological, anthropometric, biomechanical, and cognitive) required for ergonomic assessment of complex systems.									
Course outcome Students' ability to: <ul style="list-style-type: none">• understand the basic principles of cognitive, physical, systems, and organizational ergonomics;• apply ergonomic principles to improve the ergonomic design of products or systems;• assess ergonomic risk, independently or as part of a team.									
Course outline Theoretical lessons Ergonomics – origin and development: Relationship between ergonomics and other sciences. Goals and tasks of ergonomics. Physical, cognitive, organizational, systems, and environmental ergonomics. Human-machine system. Anthropometry: Anthropometric measurements, data processing. Anthropometric data variations. Reach, working positions, work spaces, workplace design (sitting and standing). Biomechanics: Basic biomechanical principles. Sensory systems: Visual sensory system, Auditory sensory system, Tactile sensory system. Memory. Decision making. Control and operation systems: Visual field and visual angles. Encoding of visual information. Indicators and displays. Indicator-command compatibility. Quantification of operators' work activities: Population stereotypes. Biological rhythms. Work hours. Shift work and work breaks. Operator fatigue. Professional stress. Concepts and methods of ergonomic design: Psychological methods. Physiological methods. Mathematical methods. Imitation methods. Ergonomic risk: Factors of ergonomic risk and their influence on the development of musculoskeletal disorders. Ergonomic risk assessment. Practical lessons Auditory/calculation exercises that follow the theoretical lessons, presentation and defence of a graphic assignment on a topic covered during theoretical lessons.									
Literature [1] Grozdanović Miroljub (1999). <i>Ergonomic design of human operator activities</i> . Nis: University of Nis, Faculty of Occupational Safety (in Serbian). [2] Pavlović-Veselinović Sonja (2013). <i>Ergonomic risk</i> . Nis: University of Nis, Faculty of Occupational Safety (in Serbian). [3] Bridger Robert (2018). <i>Introduction to human factors and ergonomics</i> . 4 th edition. USA: CRC Press. [4] Salvendy Gavriel (2012). <i>Handbook of human factors and ergonomics</i> . USA: John Wiley & Sons. [5] Dul Jan, Weerdmeester Bernhard (2008). <i>Ergonomics for beginners: a quick reference guide</i> . 3 rd edition. USA: CRC Press.									
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)	40
Activity during exercises	5		
Colloquium	30		
Graphic assignment	20		

Course name: Alarm Systems		
Course status: Elective	Course code:	19.OZNR26
ECTS credits: 6		
Requirements: -		
Course aim Study of the operating principles and applications of fire detectors and other components of fire alarm systems. Study of the operating principles and applications of burglary detectors and other components of burglary protection.		
Course outcome Students' ability to: <ul style="list-style-type: none"> • select the appropriate type and number of fire detectors to be used in a given building; • connect the selected components to a fire detection and alarm system according to the building characteristics; • select the appropriate type and number of burglary detectors to be used in a given building and space; • connect the selected components to a burglary protection system according to the building and space characteristics. 		
Course outline Theoretical lessons General information about alarm systems: Alarm systems through history. Data collection systems. Sensors and detectors. Detection of fire parameters: Fire detectors (alarms). Manual fire alarms. Heat detectors. Smoke detectors. Flame detectors. Carbon monoxide detectors. Multi-sensor fire detectors. Signalling in fire alarm systems: Sound signals. Visual signals. Power supply and installation: Power supply of fire alarm systems. Installation of fire alarm systems. Organization of fire alarm systems: Types and organization of systems. Operation of fire alarm systems. Central fire alarm unit. Testing of fire alarm systems. Design of fire alarm systems: Design basics. selection of fire detectors. Layout of fire detectors. Detection of burglary parameters: Alarm contacts. Glass break detectors. Ultrasonic motion detectors. Microwave motion detectors. Infrared motion detectors. Presence detectors. Perimeter protection: Perimeter protection using tripwires. Perimeter protection using vibration detection. Perimeter protection using underground sensor tubes. Perimeter protection using the electric field. Perimeter protection using optical cables. Perimeter protection using geophones. Perimeter protection using underground coaxial cables. Perimeter protection using motion detectors. Organization of a burglary protection system: Functional organization of the system. Basics of system design. System design methodology. Practical lessons The knowledge acquired during theoretical lessons is analyzed during practical lessons. Auditory exercises involve the demonstration of specific components and devices of alarm systems and the analysis of designs of previously implemented alarm systems. Practical exercises involve visits to facilities equipped with an alarm system and to alarm system manufacturers.		
Literature [1.] Blagojević Milan (2015). <i>Alarmni sistemi, drugo, ispravljeno i dopunjeno izdanje</i> . Niš: Univerzitet u Nišu, Fakultet zaštite na radu u Nišu [2.] Blagojević Milan (2011). <i>Alarmni sistemi, monografija</i> . Niš: Univerzitet u Nišu, Fakultet zaštite na radu u Nišu [3.] Bukowski Richard, Moore Wayne (2003). <i>Fire Alarm Signaling Systems, 3rd edition</i> . USA: NFPA		

Number of active classes (weekly)									
Lectures	2	Auditory exercises	2	Other forms of classes	-	RS	-	Other classes	-
Teaching methods									
Lectures, auditory and calculation 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: 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: <ul style="list-style-type: none">• 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). <i>Tehnički propisi o zaštiti od požara i eksplozija</i> . Beograd: SMEITS [2] Industrial ventilation: <i>A Manual of Recommended Practice</i> , 23 rd edition. USA: ACGIH [3] Perišić Živojin (1994). <i>Ventilacija porodičnih i komercijalnih kuhinja</i> . Beograd: SMEITS [4] Goodfellow Howard (2001). <i>Industrial Ventilation Design Guidebook</i> . 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: <ul style="list-style-type: none"> • 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). <i>Zaštita na radu sa postrojenjima pod pritiskom – interni materijal za pripremu ispita</i> . Niš: Univerzitet u Nišu, Fakultet zaštite na radu u Nišu [2] Isailović Miodrag, Petrović Aleksandar, Bogner Martin, Mitrović Nenad (2013), <i>Propisi o opremi pod pritiskom</i> . 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	-
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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: 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: <ul style="list-style-type: none"> • 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 sides. 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: Fire Extinguishing Agents and Equipment		
Course status: Elective	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: <ul style="list-style-type: none"> 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 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. Desmoking equipment. 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	-
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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: 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:									
<ul style="list-style-type: none">• 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). <i>Informaciona tehnologija: Principi, praksa, mogućnost</i> . Beograd: Kompjuter biblioteka									
[2] Pleskonjić Dragan, Maček Nemanja, Đorđević Borislav, Carić Marko (2007). <i>Sigurnost računarskih mreža</i> . Beograd: Mikro knjiga									
[3] Krstić Dejan, Blagojević Milan, Janačković Goran (2019). <i>Računarska tehnika - osnovi organizacije i primene personalnih računara</i> . 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: <ul style="list-style-type: none"> • understand, interpret, and meet the requirements of different management systems; • create documentation for different management systems; • integrate multiple management systems into a single integrated management system; • improve the efficiency and effectiveness of an organization's activities; • implement procedures of internal and external audits. 		
Course outline Theoretical lessons Systems of organizational business system management: basic characteristics, terms and definitions in a quality management system, terminology. Standards and standardization in management systems: historical development of management systems, standards and standardization, authorized institutions. Quality management principles: process model of management systems, systems approach, leadership, employee participation. Steps in the development and implementation of quality management systems: PDCA cycle, revised PDCA cycle. Requirements for quality management systems according to SRPS ISO 9001: quality management system principles, organizational, management system, and documentation requirements. Requirements for environmental management systems according to SRPS ISO 14001: environmental management system principles, terms and definitions in an environmental management system, documentation requirements. Requirements for occupational safety and health management systems according to SRPS ISO 45001: principles of occupational safety and health management systems, organizational and documentation requirements for management systems, professional risk analysis and management in occupational safety and health management system. Requirements for environmental management systems according to EMAS III: origin and development of EMAS standard, EMAS standard implementation steps, verification. Requirements for fire safety management systems according to standards ISO 23932, ISO 16732 and other related standards: organizational, management system, and documentation requirements. Other standards and systems: standards for laboratory accreditation, information security, corporate social responsibility, risk management, production of safe food. Creation of an integrated management system: integration models, phases and steps, principles and rules of management system integration according to BSI PAS 99 specification.		
Practical lessons Use of system standards and establishment of a system for quality management, environmental management, occupational safety and health management, and fire safety management (case studies of implementation across various sectors or in specific		

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

Literature

- [1] Vasović Dejan (2020). Interni materijal za pripremu ispita. Niš: Univerzitet u Nišu, Fakultet zaštite na radu u Nišu.
- [2] Guideline Integrated Management System (IMS). (2018). Stuttgart: AEB SE – Services.
- [3] Raković Radoslav (2014). Integrirani 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	-
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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: Industrial Structures									
Course status: Elective						Course code:		19.OZNR39	
ECTS credits: 5									
Requirements: -									
Course aim Acquisition of theoretical knowledge about industrial zones, industrial complexes, industrial facilities (workshops), and auxiliary facilities in an industrial complex, and application of acquired knowledge in occupational safety engineering.									
Course outcome Students' acquisition of skills and ability to apply their knowledge of occupational safety engineering in: <ul style="list-style-type: none">• industrial complexes;• industrial facilities;• auxiliary facilities.									
Course outline Theoretical lessons Industrial zones: Size and structure of industrial zones; the position of industrial zones in relation to residential zones. Position of industrial zones in relation to infrastructure networks, transport networks, river courses. Position of industry in relation to environmental protection requirements. Industrial complexes: Spatial organization of industrial complexes; Architectural and urban planning forms of industrial complexes, traffic in an industrial complex. Basic elements of industrial complexes: Industrial structures – workshops (workplaces; workshop dimensions; construction systems of production halls; construction elements of industrial structures: walls, floors, doors, windows; workshop lighting: natural and artificial; locker room and sanitary area, internal freight transportation, communication in workshops, noise in workshops, 'plantscaping' of workshops). Storage facilities. Energy facilities. Auxiliary facilities (administration, laboratories, guardhouses, facilities for providing healthcare services, repair shops, garages. Facilities for rest and recreation. Fire safety measures of industrial structures through architectural design and construction: Access roads, unobstructed clearances, and appropriate radiuses for firefighting vehicles to turn around. Siting of energy and other facilities of industrial complexes, storage of raw materials, products, and tools. Practical lessons Analysis of current topics pertaining to the implementation of occupational safety measures in industrial and auxiliary facilities located within industrial complexes.									
Literature [1] Milutinović Slobodan, Radosavljević Jasmina (1998). <i>Industrijski objekti</i> . Niš: Univerzitet u Nišu, Fakultet zaštite na radu u Nišu [2] Nojfert Ernest (2003). <i>Arhitektonsko projektovanje</i> . Beograd: Građevinska knjiga [3] Damjanović Vojislav (1990). <i>Industrijski kompleksi i zgrade</i> . Beograd: Građevinska 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. Students' activity during classes, discussion and analysis of syllabus topics, presentation and defence of a term paper.									

Grading (maximum number of points: 100)			
Pre-exam requirements	Points	Exam	Points
Activity during lectures	5	Written exam (practical part of the exam)	40
Activity during exercises	5		
Colloquium 1	20		
Colloquium 2	20		
Term paper	10		

Course name: Industrial Ecology		
Course status: Elective	Course code:	19.OZZS10
ECTS credits: 5		
Requirements: -		
Course aim Acquisition of skills to ascertain ecological friendliness of industrial products. Gaining knowledge to recognize opportunities for directing by-product flows toward complementary, processes in accordance with the principles of sustainable development. Ability to assess the life cycle of products and to analyse anthropogenic metabolism of a system.		
Course outcome Students would acquire knowledge and skills to: <ul style="list-style-type: none"> • assess the opportunities for improvement of industrial products and production systems in terms of environmental protection taking into account the technical and socio-economic constraints; • consider the overall environmental life cycle impacts of an industrial product; • apply basic principles and approaches to improve the efficiency of resource use and to close the loop of material flows; • plan, design and develop eco-industrial symbiosis projects, by-products exchanges, and eco-industrial networks. 		
Course outline Theoretical lessons Industrial ecology and sustainability principles: Fundamentals and historical development of the concept. Industrial growth and development. Environmental consequences of industrial development. Kuznets curve; Internalizing externalities. IPAT formula: Model of anthropogenic environmental impact - "master equation"; technological factor, exponential growth and doubling time. Consumerism. Metabolism of anthropogenic systems: Mass balance, Homeostasis. Absorption capacity of biosphere. Production system material flow analysis (MFA). Sankey's diagrams. Interaction between industrial products and the ecosystem - analogies. Introduction to life-cycle analysis (LCA) of products and processes: Development of the concept and methods. Life-cycle phases. LCA implementation stages according to ISO 1404X. Eco-design (DfE concept): Environmental friendliness criteria for mass consumption industrial products; Efficiency of resource use, dematerialization, design of recyclable structures; Biomimicry. WEEE, RoHS, and ErP directives. Ecolabels and Environmental Product Declarations (EPD); Extended Producer Responsibility (EPR). Fundamental principles of circular economy: Urban deposits. Recycling and reuse, biological and technical cycles. Eco-industrial parks: Eco-industrial symbiosis. Eco-industrial networks. Exchange of by-products. Closed loops and inter-sectorial networking. The Kalundborg model: Development, dynamics, and nature of interconnections, integration of complementary industrial sectors and public utility services. Strategic planning of waste-free anthropogenic systems. Practical lessons Elaboration of relevant topics pertaining to industrial development. Discussions on concepts, methods, and development trends in the economy and environmental protection through interactive critical thinking exercises. Numerical exercises (exponential growth and doubling time, material flow analysis); presentation of case studies and examples of good engineering practice; presentation of relevant software tools; defence of term papers.		

Literature

- [1.] Glišović Srđan (2017). *Održivo projektovanje i životna sredina*. (Sustainable Design and the Environment, *in Serbian*) Niš: Univerzitet u Nišu, Fakultet zaštite na radu u Nišu
- [2.] Graedel E. Thomas, Allenby R. Braden (2010). *Industrial Ecology and Sustainable Engineering*, Pearson
- [3.] Hodolić Janko, Vukelić Đorđe, Hadžistević Miodrag, Budak Igor, Badida Miroslav, Šooš Lubomir, Kosec Borut, Bosak Martin (2011). *Reciklaža i reciklažne tehnologije*. (Recycling and recycling technologies, *in Serbian*) Novi Sad: Univerzitet u Novom Sadu, Fakultet tehničkih nauka
- [4.] *Osnove cirkularne ekonomije* (2016). Privredna komora Srbije, GLZ, Beograd
- [5.] Petrović Branislav, Dakić Ratko (2002). *Osnove teorije sistema*. Novi Sad: Univerzitet u Novom Sadu

Number of active classes (weekly)

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

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

Grading (maximum number of points: 100)

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

Course name: Technical System Maintenance		
Course status: Elective	Course code:	19.OZNR43
ECTS credits: 5		
Requirements: -		
Course aim <ul style="list-style-type: none"> • Learning about the basics of maintenance systems, nature of technical system failures, maintainability of technical systems, and elements of maintenance system management; • Proficiency in modern and generally accepted concepts of technical system maintenance for the purpose of equipment safety and prevention of technological process failures, through analysis of actual problems within the economy. 		
Course outcome Students' technical-practical skills and ability to: <ul style="list-style-type: none"> • think and make decisions like engineers by associating theoretical knowledge acquired from related technical courses and by applying interdisciplinarity in their work; • appropriately select an adequate method for machine and device maintenance out of multiple possible methods, and thus, with the help of proper safety measures, create conditions for increased efficiency and effectiveness of the production process. 		
Course outline Theoretical lessons Fundamentals of maintenance systems: Development of maintenance systems. Importance of technical system maintenance. Goals and principles of technical system maintenance. Definitions of maintenance. General approach to the maintenance system. Maintenance system structure. Maintenance planning: basics of planning; maintenance plans; maintenance as a function of a business system. Maintenance and life-cycle costs. Maintenance organization. Maintenance logistics. Technical system effectiveness. Technical system failures: Classification and types of failures. Maintenance and failure analysis: failure rate coefficient; maintenance depending on the type of failure; maintenance after sudden failures; maintenance during gradual failures. Failure diagnostic methods: subjective diagnostics; objective diagnostics; identification of state during technical system inspection. Maintainability: Indicators of maintainability. Prediction of maintainability. Influence of maintainability on a technical system. Factors of maintainability: construction factors; logistic factors. Characteristics of maintainability: quantitative characteristics; qualitative characteristics. Analysis of maintainability prediction. Maintenance engineering: Technical system maintenance for the purpose of safety. Influence of maintenance engineering on the safety of technical system operations. Systems approach to maintenance for the purpose of safety. Life-cycle analysis of technical systems regarding safety. Principles of technical system design in terms of their maintainability. Maintenance system management: Maintenance strategies. Basic methodologies of maintenance. Methodology of reliability-centred maintenance: philosophy and principles of reliability-centred maintenance; definition of failure within the process of reliability-centred maintenance; influence of reliability-centred maintenance on the system's life cycle. Fundamental concepts of maintenance systems. Modern concepts of maintenance. Preventive maintenance – time-based preventive maintenance; state-based preventive maintenance; inspection planning; basic activities of preventive maintenance; basic requirements for a successful introduction of preventive		

maintenance; advantages of state-based preventive maintenance. System state diagnostics. Determination of time for preventive part replacement. Preventive maintenance costs. Quality of maintenance. Optimization of maintenance systems. Realization of maintenance programs. Administrative procedures of maintenance processes. Organization of operative preparation of maintenance. Information systems maintenance management: information system; data processing; characteristics of the maintenance information system; information pertaining to technical system maintenance; goal and structure of the maintenance information system; planning and programming of maintenance activities.

Practical lessons

Calculation exercises: Solution of calculus problems for the purpose of determining life-cycle costs, failure rate coefficient, quantitative characteristics of maintainability, and characteristics of technical system reliability.

Organized visits to companies for the purpose of analyzing maintenance processes of different technical systems in real conditions.

Literature

[1] Janković Žarko (2017). *Tehnički sistemi zaštite*. Niš: Fakultet zaštite na radu u Nišu.

[2] Janković Žarko (2017). *Održavanje tehničkih sistema*. Niš: Fakultet zaštite na radu u Nišu.

[3] Papić Ljubiša, Milovanović Zdravko (2007). *Održavanje i pouzdanost tehničkih sistema*. Čačak: Istraživački centar DQM - Prijedor

Number of active classes (weekly)

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

Lectures, auditory (calculation) exercises, office hours, visits to companies. 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: Industrial Waste Treatment		
Course status: Elective	Course code:	19.OZNR44
ECTS credits: 5		
Requirements: -		
Course aim Acquisition of knowledge about industrial waste generation, waste characteristics, waste management methods in production systems, and industrial waste treatment systems and devices.		
Course outcome Students' ability to: <ul style="list-style-type: none"> • describe and categorize industrial waste; • select methods, procedures, and techniques of waste management at the generation site; • select systems and devices for the treatment of industrial waste gases and waste water; • monitor and control the efficiency of systems and devices; • select methods for treatment and final disposal of industrial waste. 		
Course outline Theoretical lessons: Production processes as waste generators: Definition and classification of waste. Categorization and characterization of waste from production processes. Regulations and standards for waste management. Ecological dimensions of industrial waste management: Definition, classification. Minimization of gaseous and liquid waste. Purification, phase separation, phase transformation. Waste gas treatment: gravity separation, inertial separation, centrifugal separation, filtration, electrostatic separation, separation in scrubbers, sorption gas phase separation methods: absorption, adsorption, desorption. Wastewater treatment methods: mechanical methods, biochemical methods, chemical methods, sludge treatment. Devices and facilities for the treatment of waste water from specific industries. Industrial solid waste management methods: documentation accompanying waste pathway, industrial waste handling, waste separation, temporary storage, reuse of waste, physical and mechanical methods of waste treatment, thermal methods, biothermal methods, waste composting. Practical lessons Auditory/calculation exercises that follow the theoretical lessons, presentation and defence of term papers on a topic covered during theoretical lessons. Calculation exercises include the calculation of the material balance of waste gas treatment devices, determination of their efficiency, their sizing (gravity settling chambers, inertial impactors, cyclones, electrostatic precipitators and filters), as well as settling chambers for wastewater treatment. Practical lessons also include visits to wastewater treatment plants and to facilities with waste gas treatment devices within the selected industrial complex.		
Literature [1.] Živković Nenad (2020). <i>Prečišćavanje industrijskih otpadnih materija</i> . Niš: Univerzitet u Nišu, Fakultet zaštite na radu u Nišu [2.] Živković Nenad (2001). <i>Visokoefektivni filtri u ekotehnici čistih soba</i> . Niš: Univerzitet u Nišu Fakultet zaštite na radu u Nišu [3.] Bogner Martin (2001). <i>Tehnika prečišćavanja</i> . Beograd: Univerzitet u Beogradu, Mašinski fakultet [4.] Ilić Marina, Miletić Saša (1998). <i>Osnovi upravljanja čvrstim otpadom</i> . Beograd: Institut za ispitivanje materijala		

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

Course name: Psychophysiology of Work									
Course status: Elective						Course code:		19.OZNR45	
ECTS credits: 5									
Requirements: -									
Course aim Acquisition of knowledge about psychophysiology of work, its role and importance for health protection and improvement and for work success.									
Course outcome Students' acquisition of skills and ability to: <ul style="list-style-type: none">• protect and preserve physical and mental health of individuals in the work and natural environments;• organize shift work and select adequate human resources (personnel) for shift work;• identify signs of fatigue, prevent fatigue, and properly implement measures to eliminate the effects of fatigue.									
Course outline Theoretical lessons Scope, subject matter, and task of psychophysiology of work: Aim of psychophysiology of work. Psychophysiology of work and related disciplines. Definitions of work. Functional and morphological conditionality of work. Types of work. Types of muscle tissue. Physical characteristics of muscles. Isotonic and isometric muscle contraction. Dynamic and static work. Psychophysiological bases of mental work: Difference between intellectual and physical work. Cardiovascular synergies. Synergies of respiratory organ systems. Dead spot and second wind. Hyperventilation syndrome. Circadian rhythm: Definition of rhythm; cycle, period, phase, and amplitude of circadian rhythm. Factors of rhythmicity (conditionality of rhythm). Zeitgeber or a natural circadian clock synchronizer. Hormonal, physiological, and psychological parameters exhibiting circadian rhythmicity. Desynchronization, resynchronization, and dissociation of rhythm after a change in circadian rhythmicity. Causes of circadian rhythm changes in humans. Jet lag. Circadian rhythms and shift work. Shift work and organization of work: Findings about circadian rhythmicity and their application in the work process. Rhythm of body temperature and mental capacities. Morning and evening personality types ('larks' and 'owls'). Family and social aspects of shift work. Influence of shift rotation with night work on human psychophysiological status. Fatigue and rest: Definition of fatigue. Types of fatigue. Theories of onset of fatigue. Objective signs of fatigue. Behavioural signs of fatigue. Methods of fatigue detection. Prevention of fatigue. Chronic fatigue syndrome. Burnout. Rest. Active rest. Physiological, psychological, and pharmacological stimulators to prevent fatigue. Doping. Stress and work: Definition of stress. Stressors. Classification of stressors. Physiological reactions. Mental reactions. Physiological theory of stress. Measurement of stress. Physical exertion and stress. Psychological theories of stress. Psychosomatic disorders as a consequence of stress. Practical lessons Exercises include the presentation and defence of term papers on topics covered during theoretical lessons.									
Literature [1.] Živković Snežana, Milenović Miodrag, Obrenović Joviša (2019). <i>Psihofiziologija rada</i> . Niš: Univerzitet u Nišu: Filozofski fakultet u Nišu									
Number of active classes (weekly)									
Lectures	2	Auditory exercises	2	Other forms of classes	-	RS	-	Other classes	-

Teaching methods			
Oral exposition (lectures), term papers, discussions, office hours.			
Grading (maximum number of points: 100)			
Pre-exam requirements	Points	Exam	Points
Activity during lectures	10	Oral exam (theoretical part of the exam)	40
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: <ul style="list-style-type: none"> • 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.] Arandelović Mirjana, Jovanović Jovica (2009). <i>Medicina rada</i> . 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	-
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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		

