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| **Study program** Applied chemistry with the management basics |
| **Course title** Advanced environmental chemistry course (H252C) |
| **Name of lecturer/lecturers** Tatjana D. Anđelković |
| **Type of course** Obligatory |
| **Number of ECTS allocated** 5 |
| **Course objectives**Provide knowledge about important chemical processes in the lithosphere, atmosphere, and hydrosphere. Develop abilities to solve theoretical and experimental problems in monitoring and distribution of pollutants. Use software in geochemical modeling. |
| **Course outcomes**The student is able to: describe the chemical and physical characteristics of soil, water and air; explain how salinization, acidification, change in redox status and soil contamination affects ecological status of soil; draw and use diagrams for relation between concentration of chemical species and one and/or two variables; compare chemical processes in water in open and closed systems; consider thermodynamic and kinetic control of atmospheric processes using appropriate examples, as well as to determine the most important conditions for the development of photochemical reactions in the atmosphere; model the distribution of metals of anthropogenic or natural origin in life environment using computer speciation software; sample soil, air and water, prepare samples for analysis; achieve oral and written communication, independent work, self-organization and professional work planning. |
| **SYLLABUS***Lectures*Atmosphere - layers, profile, atmospheric reactions, calculations. Chemistry of the stratosphere. The origin and decomposition of ozone/oxygen. Catalytic decomposition of ozone. Chemistry of the troposphere. Smog. Photochemical smog. Exhaust gases from internal combustion engines. Precipitation. Atmospheric aerosols. Physical and chemical properties of soil. Soil leaching and erosion. Soil acidification and salinization. Kinetics of chemical processes in soil. Redox processes of soils. Metals in soil. Hydrosphere. Physical and chemical characteristics of water. Distribution of chemical species in aquatic environments (diagrams with one variable, diagrams with two variables, pE/pH diagrams). Measurement of pE. Gases in water (gases that react and do not react with water). Organic matter in water (aquatic humic substances). Metals in the hydrosphere (aqua metal complexes, classification of metals, behavior of metals in the environment - example: calcium, cadmium, mercury, metallic complexes with ligands of anthropogenic origin, suspended matter of the hydrosphere). Colloids and surfaces (surface properties of colloidal materials, quantitative description of adsorption). Colloids and surfaces (partition of organic matter between water and soil/sediment, colloidal materials in environment). Microbiological processes (classification of microorganisms, microbiological processes –carbon cycle, nitrogen cycle, sulfur cycle). Water pollution and wastewater treatment (communal water treatment of wastewater, biological processes of phosphorus and nitrogen removal from wastewater, anaerobic digestion of sludge). Organic biocides (chemical stability, mobility, leaching). Transformational processes of organic biocides (hydrolysis, redox reactions, direct and indirect photolysis, biological transformations).*Laboratory work*Field sampling of air, water, and soil. Field analysis of water quality parameters. Heavy metals in plant material. Chromium in wastewater. Orthophosphates in surface waters. Disinfectant means of water. Pesticide residues in soil and water samples. Modeling of processes in the environment. Using the MINTEQA2 software package. Solving a specific problem using software of the MINTEQA2 package. Construction and interpretation of pH-pC diagrams in closed and open systems. Using the pH-pC simulator software package. Using the FATE© program package for calculation transport of pollutants in rivers. Remote access GC/MS (NETCHEM remote access platform). |
| **References**1. P. Pfendt, Hemija životne sredine I deo, Zavod za udžbenike, Beograd, 2009.2. D. Veselinović, I. Gržetić, Š. Đarmati, D. Marković, Fizičkohemijski osnovi zaštite životne sredine-izvori zagađenja, posledice I zaštita, knjiga druga, Naučna knjiga, Beograd, 1997.3. Gary W. Van Loon, Stephen J. Duffy, Environmental chemistry – a global perspective, Oxford UniversityPress, Oxford, 2000.4. Eldon D. Enger; Bradley F. Smith; Heidi Marcum; David A. Aborn; W. Merle Alexander, Field & LaboratoryExercises in Environmental Science, McGraw-Hill Science Engineering, 1999.5. Miroslav Radojević, Vladimir Bashkin, Practical Environmental Analysis, Royal Society of Chemistry,Cambridge, 1999.6. A series of electronic teaching materials developed within the ERASMUS+ NETCHEM project(http://mdl.netchem.ac.rs/course/view.php?id=3 ) |
| **Active teaching classes** | **Lectures** 45 | **Laboratory work** 15 |
| **Teaching mode**Lectures, interactive teaching, laboratory work, consultations. |
| **ASSESSMENT METHODS AND CRITERIA (Max 100 points)** |
| **Pre exam duties** | **Points** | **Final exam**  | **Points** |
| Activity during lectures | 4 | Written examination |  |
| Practical teaching | 20 | Oral examination | 30 |
| Teaching colloquia | 46 |  |  |
| Seminar |  |  |  |