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| **Title of the course:**  Environmental analytics-Analytical chemistry | | **NEPTUN-code:**  RKXKA1EBNF | **Weekly teaching hours:** l+cw+lb  2+0+3 | **Credit:** 5  **Exam type**: tm |
| **Course leader:**  Dr. Mészárosné Dr. Bálint Ágnes Ilona | | **Position:**  associate professor | **Required preliminary knowledge:**  RMXKE2KBNF, RKXFI1EBNF  RMXKE2KBLF, RKXFI1EBLF | |
| **Curriculum** | | | | |
| The aim of the course is to present the possibilities and analytical methods for testing toxic pollutants released into the environment as a result of human activity. Environmental analytics uses analytical chemistry and other techniques to study our environment. The primary goal is to introduce the possibilities of sampling from different environmental elements (atmosphere, surface and subsurface water, and soil) and thereby assess whether they are contaminated with organic and inorganic toxic substances. The course covers the physical and chemical fundamentals of environmental analysis, introduces various validation methods, and emphasizes the importance of standardization. Students learn about various sampling and sample preparation procedures, review atomic and molecular spectroscopic techniques, and learn about the most important separation techniques. During laboratory exercises, students apply the methods learned in theory to environmental samples, measuring them using appropriate analytical instruments, from sampling to sample preparation, to determine whether they contain any inorganic or organic toxic substances. | | | | |
| ***Detailed schedule of the course:*** | | | | |
| **Weeks** | **Topics of lectures and exercises** | | | |
| 1. | General introduction, accident prevention, laboratory rules, calculation exercises, alkalinity of water | | | |
| 2. | Sample preparation, classical analyses, electroanalytics, chemical oxygen demand, solid phase extraction | | | |
| 3. | AAS, ICP, X ray, | | | |
| 4. | Cromatography | | | |
| 5. | gas chromatography | | | |
| 6. | MS, quality management, validation | | | |
| 7. | Replacement | | | |
| 8. | The importance of chemical analysis. Contaminant transport processes in the environment. The concept, fields, and tasks of environmental analysis. The process and main steps of environmental analysis. The most important performance characteristics (lower measurement limit, measurement uncertainty). Requirements for the methods used, the concept of limit values, their types, and practical application. Documentation. Formal and content requirements for the sampling plan, sampling report, and test report. | | | |
| 9. | Quality assurance, accreditation, legal requirements for the methods used. Classification of methods (standards, standardization, other methods). Traceability to international standards. The concept and application of certified reference materials. Validation, verification. | | | |
| 10. | Sampling rules. Sample preparation. The problem of representative sampling, types of samples and sampling. Quality assurance in sampling. On-site and laboratory testing. Special sampling problems (rapidly changing environment). | | | |
| 11. | Sampling and testing of soil and groundwater. Legal requirements, inorganic and organic chemical testing. Issues related to waste sampling and testing. Special sampling and testing for disposal by landfilling and utilization as SRF. Sampling of municipal waste. | | | |
| 12. | Surface water sampling and testing. Analytical requirements of the Water Framework Directive. Analytical problems of organic pollutants present in low concentrations. Wastewater sampling and testing. The concepts of qualified point sampling, time-proportional sampling, and volume-proportional sampling. Limit values and their interpretation. Technological and emission control tests. Wastewater self-monitoring plan. Drinking water utility service measurements. Well base tests, end point control. Chemical and biological parameters. | | | |
| 13. | Air quality measurements. Sampling and testing of ambient air, workplace air, and emitted air pollutants. Limit values, their application and interpretation. Rolling average and smog alerts. Special issues: Indoor air quality, measurement of environmental odors. | | | |
| 14. | Midterm evaluation. written test. | | | |
| **Mid term requirements** | | | | |
| *Attendance at lectures:*  It is compulsory to attend the lectures. The rules of education and exam directory (TÜ) are the guidelines. | | | | |
| *Exams and tests (types, data)*  One mid term written test.  Written exam. | | | | |
| *Methods of qualification:*  Basis of marking: attendance at lectures and practical works. Written mid term test (100 points).  Written exam (100 points).  Marking: Total points from two tests = 100 points  0-40 points: fail (1), 41-55 points: pass (2), 56-70 points: satisfactory (3), 71-85 points: good (4), 86-100 points: excellent (5) | | | | |
| **Professional competencies:** | | | | |
| * Knowledge of general and specific mathematical, natural and social scientific principles,   rules, relations, and procedures as required to pursue activities in the special field of  environment protection.   * In possession of state-of-the-art IT skills, being able to use professional databases and   certain design, modelling, and simulation software depending on their specialty.   * Knowledge of the learning, knowledge acquisition, and data collection methods of the   special fields of environment protection, their ethical limitations and problem solving  techniques.   * Comprehensive knowledge of the basic features and interrelations of environmental   elements and systems, as well as of the environmentally harmful substances affecting them.   * Knowledge of the methodology and legal regulations for performing environmental impact assessments and for compiling impact studies. * Able to perform basic tests of the quantity and quality characteristics of environmental   elements and systems by state-of-the-art measuring instruments; to draw up and implement measurement plans; and to evaluate data.   * Able to solve tasks of water, soil, air, radiation, and noise protection, as well as of waste   treatment and processing at proposal level; to participate in preparing decisions; to perform authority audits; and to take part in the operation of these technologies.   * Able to perform environmental impact assessments and to participate in compiling impact studies. * Able to apply in practice as well the regulations and requirements of health and safety, fire protection, and safety engineering as related to their special field. | | | | |
| **Literature** | | | | |
| 1. David Harvey: Modern Analytical Chemistry, McGraw Hill, Boston Burr Ridge, IL   Dubuque, IA Madison, WI New York, San Francisco, St. Louis, Bangkok, Bogotá Caracas, Lisbon, London, Madrid, Mexico City, Milan, New Delhi, Seoul, Singapore, Sydney, Taipei, Toronto, 2000   1. Gary D. Christian: Analytical Chemistry, John Wiley and Sons Inc., 2004 2. Edited by Ira S. Krull: Analytical Chemistry, ISBN 978-953-51-0837-5, 154 pages,   Publisher: InTech, Chapters published November 07, 2012 under CC BY 3.0 license  DOI: 10.5772/3086 | | | | |