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| **Study program** Chemistry | | | | |
| **Course title** Instrumental analytical chemistry (H134C) | | | | |
| **Name of lecturer/lecturers** Aleksandra N. Pavlović | | | | |
| **Type of course** Obligatory | | | | |
| **Number of ECTS allocated** 7 | | | | |
| **Course objectives**  Acquisition of theoretical and practical knowledge of optical and electroanalytical instrumental methods analysis, as well as training students to use instruments to plan and execute scientific research work. Understanding the role, importance, and areas of application of simpler instrumental analysis methods. | | | | |
| **Course outcomes**  Upon successful completion of this course, the student can: understands the principles of optical and electroanalytical methods of instrumental analysis; explain and differentiate the parts of instruments used for recording (sources, optical systems for focusing and collimation, atomizers, sprayers, monochromators, detectors); analyzes the types of interference that may occur during the analysis; recognize the applicability of instrumental methods of analysis in concrete cases; correctly handles specific instruments for physical and chemical analysis of the tested samples; measures precisely and accurately when performing assigned instrumental analyzes and interprets experimental results and writes reports on the performed analysis. | | | | |
| **SYLLABUS**  *Lectures*  Division of instrumental methods of analysis. Electromagnetic radiation. Scheme of spectral apparatus. Source of discontinuous radiation: flame, lamp with a hollow cathode, ICP. Lenses and mirrors. The incision spectral apparatus and section illumination. Aberration of optical systems. Dispersion elements: filters, prism, and diffraction optical grating. Characteristics of spectral apparatus: linear dispersion, angular dispersion, resolving power. Photoelectric and radiometric radiation detection. Emission optical methods. The intensity of the spectral line. Flame emission spectrometry. Absorption methods. Laws of light absorption. Deviation from the Lambert-Beer law. Colorimetry and photocolorimetry. Spectrophotometry in the UV/Vis range. Spectrophotometric determination of two-component mixtures. Spectrophotometric titrations: titrations without indicators, titrations with an indicator, and titration of a mixture. Atomic absorption spectrophotometry (AAS). Infrared spectrophotometry (IR). Refractometry. Interferometry. Polarimetry. Nephelometry and turbidimetry. Direct conductometry. Determination of the dissociation constant weak acids and bases. Determination of solubility products. Conductometric titrations: acid-base titrations, chemical exchange systems, titrations of complexing systems, titrations depositional systems. Direct potentiometry. Ionometry. Types of electrodes. Potentiometric  titrations: acid-base titrations, precipitation titrations, complexometric titrations, and redox titrations. Potentiometric titrations in non-aqueous media. Determine titration endpoints in cells with one indicator and one reference electrode. Methods for determining the end point of titration in cells with two indicator electrodes. Electrolysis and electrogravimetry. Coulometry. Coulometric titrations: acid-base titrations, precipitation titrations, complexometric titrations, and redox titrations. Chemical coulometers.  *Laboratory work*  Spectrophotometric determination of Fe(II) ions. Spectrophotometric titration of Bi3+ and Cu2+ ions in a mixture. Turbidimetric determination of sulfate. Photocolorimetric determination of concentration colored Cu2+ solution. Colorimetric determination of MnO4- using Duboscq's colorimeter. Determination of the concentration of the dissolved substance based on the deflection angle. Conductometric determination of the dissociation constant of weak acids. Conductometric determination of the product solubility of a poorly soluble compound. Conductometric titration of H2SO4 and CH3COOH in a mixture. Precipitation conductometric titration of BaCl2 with K2SO4. Potentiometric titration of H3PO4 with NaOH. Potentiometric titration of CH3COOH with NaOH. Potentiometric titration of oxalate and succinic acid in a non-aqueous solution. Electrogravimetry determination of copper. | | | | |
| **References**  1. V. Jokanović, Instrumentalne metode: ključ za razumevanje nanotehnologije i nanomedicine, Inžinjerska akademija Srbije i Institut za nuklearne nauke „Vinča“, Beograd, 2014.  2. M. Todorović, P. Đurđević, V. Antonijević, Optičke metode instrumentalne analize, Hemijski fakultet, Beograd, 1997.  3. S. Mitić, Elektroanalitička hemija, Prirodno-matematički fakultet u Nišu, Niš, 2008.  4. D. A. Skoog, D. M. West, F. J. Holler, Fundamentals of Analytical Chemistry, Saunders College Publishing, Philadelphia, 1996. (prevod: Školska knjiga, Zagreb, 1999.)  5. S. Mitić, A. Pavlović, V. Živanović, Zbirka zadataka iz instrumentalne analitičke hemije, Prirodno-matematički fakultet u Nišu, Niš, 2012. | | | | |
| **Active teaching classes** | **Lectures** 60 | | **Laboratory work** 45 | |
| **Teaching mode** lectures, laboratory exercises, demonstration, consultation | | | | |
| **ASSESSMENT METHODS AND CRITERIA (Max 100 points)** | | | | |
| **Pre exam duties** | **Points** | **Final exam** | | **Points** |
| Activity during lectures | 5 | Written examination | | 15 |
| Practical teaching | 20 | Oral examination | | 30 |
| Teaching colloquia | 30 |  | |  |