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| **Basic data of the subject** |
| **Academic Unit:** | **Department of Chemistry, Faculty of Mathematics & Natural Sciences,**  |
| **Course title:** | **Spectrometric methods in chemistry** |
| **Level:** | **Master – Physical Chemistry and inorganic chemistry** |
| **Course status:** | **Mandatory** |
| **Study year:** | **II (second) / IX (ninth semester)**  |
| **Number of hours per week:** | **2+2** |
| **Credit value – ECTS:** | **6** |
| **Time / location:** | **Will be appointed by the Department** |
| **Lecturer:** | **Prof. Dr. Ramë VATAJ** |
| **Contact details:** | **Email:** rame.vataj@uni-pr.edu/ **Tel:** /038-229-964/ |
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| **Course description:** | Spectroscopic techniques used in the analysis of the structure of molecules, the basic principles, concepts, application. Atomic spectroscopy, atomic absorption spectroscopy and atomic fluorescence. Atomic emission spectroscopy, atomic mass spectroscopy, X-ray atomic spectroscopy, molecular absorption spectroscopy (infrared, visible, ultraviolet). Molecular Fluorescence and Luminescence. The influence of several parameters in reading and interpretation of spectra and determination of structure of the molecules with the help of various techniques learned. |
| **Course objectives:** | Since the development of technology and the discovery of new substances is increasing constantly, it is necessary that students have sufficient knowledge of spectrometric methods of analysis of the structure of molecules. These methods are related to many chemistry fields, such as organic chemistry, biochemistry, pharmacy, food industry, biology, etc. |
| **Learning outcomes:** | After completing this module, students will be able to:* Understand and have basic knowledge on spectrometric methods.
* Have good practice skills for different techniques for the characterization of different materials, substances or chemical elements.
* Identify and use adequate spectrometric techniques for analyzing various structures of organic compounds and macromolecules.
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| **Contribution on student load (must correspond with learning outcomes)** |
| **Activity** | **Hours** | **Days/weeks** | **Total** |
| Lectures | 2 | 2/ 15 | 30 |
| Exercise theoretical/laboratory | 2 | 2/15 | 30 |
| Contact with lecturer/consultations | 2 | 2/15 | 30 |
| **Total** | **6** | **6/15** | **90** |
| **Teaching methods:**  | Lectures, discussions, numerical and practical exercises, seminar work, and group work. |
| **Evaluation methods:** | * Attendance in lectures and practical work 10%
* Seminar work 20%
* Regular attendance 10%
* Final exam 60 %
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| **Literature** |
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 **Basic Literature:**  | 1. 1. Douglas A. Skoog, F. James Holler, Timothy A. Nieman, “Principes d’analyse instrumentale”, *traduction de* *5e édition*, 2003, De Boeck, Paris, Bruxelles.

2. Francis Rouessac, Annick Rouessac, “Analyse chimique, Méthodes et techniques instrumentales modernes”, 6e édition, 2004, Dunod, Paris. |
| **Additional Literature:**  | 1. Robert M. Silverstein, Francis X. Webster, David J. Kiemle, “Spectrometric Identification of Organic Compounds”, *seventh edition*, 2005, John Wiley & Sons.
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| **Designed study plan:** |
| **Week** | **Lectures which will be held** |
| ***First week:*** | Introduction to spectrometric techniques used in the analysis of the structure of molecules.Basic principles, concepts, application. |
| ***Second week:*** | Atomic spectroscopy, introduction to methods and emission spectrometric atomic absorption. |
| ***Third week*:** | Atomic absorption spectrometry and atomic fluorescence spectrometry. |
| ***Fourth week:*** | Atomic emission spectrometry, atomic mass spectrometry, X-ray atomic spectrometry |
| ***Fifth week:***  | Molecular absorption spectrometry. Visible and ultraviolet spectroscopy. |
| ***Sixth week*:** | Infrared spectroscopy. |
| ***Seventh week:***  | Molecular Fluorescence and Luminescence. |
| ***Eighth week:***  | **First mid-term evaluation** |
| ***Ninth week:***  | Nuclear magnetic resonance (NMR). |
| ***Tenth week:*** | NMR spectra of 1H and 13C. |
| ***Eleventh week*:** | One and two dimensional NMR. |
| ***Twelfth week* :**  | Mass spectrometry. |
| ***Thirteenth week*:**  | The mass spectra of some elements and organic compounds group. Some applications of mass spectrometry. |
| ***Fourteenth week*:**  | The influence of several parameters in reading and interpretation of spectra and structure determination of molecules with the help of various techniques are studied. |
| ***Fifteenth week*:**  | **Seminar work - Student’s presentation.** |
| **Week** | **Exercises which will be held** |
| ***First week:*** | Introduction to spectrometric techniques used in the analysis of the structure of atoms and molecules. |
| ***Second week:*** | Study of the spectral lines of sodium atoms by means of the spectroscope and the calculation of characteristics of each spectral line. |
| ***Third week:*** | Identification of different atoms in the sample based on spectral lines acquired in the spectroscope. |
| ***Fourth week:*** | Determination of isosbestic point of compounds that absorb radiation in the UV-VIS range of spectrum. |
| ***Fifth week:*** | Derivative analysis of UV-VIS spectra. |
| ***Sixth and seventh week:*** | Registration and analysis of fluorescence spectra of some fluorescent compounds. |
| ***Eighth and ninth week:*** | Interpretation of spectra of different examples of UV spectra, IR, 1H and 13C RBM and MS with unknown structure (without structural formula). |
| ***Tenth and eleventh week:*** | Interpretation of spectra of different examples of UV spectra, IR, 1H and 13C RBM and MS with known structure (with empirical formula). |
| ***Twelfth and thirteenth week:*** | Interpretation of spectra of different examples of UV spectra, IR, 1H and 13C RBM and MS with unknown structure (without structural formula). |
| ***Fourteenth week:*** | Interpretation of spectra of the different examples of UV spectra, IR, 1H and 13C RBM and MS with known structure (with structural formula). |
| ***Fifteenth week:*** | **Evaluation test** |

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| **Academic policies and rules of conduct:** |
| Attendance at lectures and exercises should be regular and scheduled time. Students must be in commensurate to the general rules of the university. For specific rules and specifics of organizing lectures and exercises, students are notified by the professor of the course. |