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| **Study program:** Doctoral academic studies **-** Chemistry |
| **Course title:** Molecular Spectroscopy (H332C) |
| **Name of lecturer/lecturers:** Emilija T. Pecev-Marinković |
| **Type of course:** elective |
| **Number of ECTS allocated:** 10 |
| **Course objectives** Introducing students with the basic principles of molecular spectroscopy, changes in the energy states of molecules occurring in the processes of interaction, absorption, emission and scattering of radiation and matter. The students building on their knowledge acquired at previous levels of study to understand formation of molecular spectra, structure of the molecules' spectra of (linear, diatomic and multiatomic), as well as solving specific problems. |
| **Course outcomes** The student will be able to: - understand how experimental and theoretical methods are complemented to interpret spectra,- interpret spectra to get information about the structure of molecules,- based on the acquired theoretical and practical knowledge apply the same in concrete cases,- successfully and thoroughly explain the laws by which phenomena occur obey,- clearly explain the areas covered by the subject in writing and orally on the given topic. |
| **SYLLABUS***Lectures*Introduction to molecular spectroscopy. Subject of study and application. The total energy of the molecule, potential curves. Types of molecular spectra and regions of their appearance. Obtaining molecular spectra (absorption and emission). Born-Oppenheimer theory. Transition moments, transition intensity and width of spectral transitions. Rotational and vibrational molecular spectra of polyatomic molecules. Franck-Condon progression in electronic spectra of polyatomic molecules. Selection rules for spectra in the IR region and Raman scattering. Spectra of condensed systems. Application of IR spectra of gases and steam and condensed systems. Raman spectra and the Raman effect. Rotational and vibrational Raman spectra. Resonance and electronic Raman spectra. Intensity of Raman bands, exclusion rules. Comparison of IR and Raman spectra. Application of Raman spectra. Resonance Raman spectroscopy. Polarization in Raman scattering. Electronic spectra of molecules. Molecular orbitals (diagram). Electronic switches. Molecule dissociation energy. Isotope effect. Electronic spectra of benzene and vibrational structure. Molecular-orbital diagrams. Intensity of absorption bands. Spectra of organic compounds Spectra of inorganic compounds (d-d transitions, crystal ligand field theory). Charge transfer transitions. Photoelectron spectroscopy. Ultra – purple photoelectron spectrum of molecules. X-ray fluorescence spectroscopy. Laser spectroscopy. |
| **References**1. A. A. Jovanović, Molekulska spektroskopija, Fakultet za Fizičku hemiju, Beograd, 2002.2. Ј. М. Hollas, Modern Spectroscopy, John Wiley & Sons, Chichester, 2004.3. J. L. Me Hale, Molecular Spectroscopy, Upper Saddle River, Premtice Hall, 1999.4. Ž. Bariol, Ž-L. Rivas, Spektroskopije molekula, Fakultet za Fizičku hemiju, Beograd, 1992.5. F. Rouessac, A. Rouessac, Chemical Analysis, John Wiley and Sons, Chichester, England, 2008.6. J. L. McHale, Molecular Spectroscopy, Prentice Hall, New Jersey, 1999.7. P. Atkins, J. De Paula, Physical Chemistry, 8th ed., Oxford University Press, New Jork, 2006.8. Serija elektronskih nastavnih materijala razvijenih u okviru ERASMUS+ NETCHEM projekta (<http://mdl.netchem.ac.rs/course/view.php?id=45>). |
| **Active teaching classes** | **Lectures:** 105 | **Laboratory work:** / |
| **Teaching mode:** lectures, seminar, consultations |
| **ASSESSMENT METHODS AND CRITERIA (Max 100 points)** |
| seminar - 40 points; oral exam - 60 points |