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| **Study program** Master Studies | | | | |
| **Course title** Advanced course in physical chemistry (H208C) | | | | |
| **Name of lecturer/lecturers** Milan N. Mitić | | | | |
| **Type of course** Obligatory | | | | |
| **Number of ECTS allocated** 5 | | | | |
| **Course objectives**  The objective of the course is to provide students with more detailed information on selected scientific areas of physical chemistry, with an emphasis on current theoretical and practical information in the field of kinetics of electrode processes, energy conversion and chemical sensors. | | | | |
| **Course outcomes**  Having finished this course successfully, a student will be able to: distinguish and analyze the factors that determine the speed of electrochemical reactions, distinguish non-renewable from renewable sources and ways of energy conversion, as well as, based on the acquired knowledge about the principles of the functioning of sensors in chemistry, successfully apply them to different goals. | | | | |
| **SYLLABUS**  *Lectures*  Electrical conductivity of non-aqueous electrolyte solutions. Melts, electrochemical properties, models  (structure). Melt transport properties, electrical conductivity. Molar conductivity of melt, transfer numbers. Solid electrolytes, method of current transfer and transmission numbers. Concentration galvanic elements with and without transmission. Kinetics of electrode processes: Structure of the boundary surface of phases. The structure of the electric double layer. Mass transfer in an electrochemical cell: diffusion, migration. ButlerFollmer equation. IE curve of reversible electrochemical reaction. Tafel analysis. Diffusion process control and diffusion overvoltage. Reaction and phase overvoltage. Overvoltage at electrolytic hydrogen extraction. Energy conversion: Basic principles. Direct conversion of solar energy into thermal and electrical energy. Electrochemical energy conversion. Primary and secondary chemical current sources, source power, degree of utilization of active mass. Chemical sensors: sensor properties, linear region and response time. Electrochemical sensors, division. Conductometric sensors. Potentiometric sensors with solid electrolyte. Voltammetric (amperometric) sensors. Chemically modified electrodes. Optical sensors.  *Laboratory work*  1. Determination of the dissociation constant of weak acids in non-aqueous media  2. Determination of the molar conductivity of electrolytes at infinite dilution in non-aqueous media  3. Electrolytic separation and determination of copper and lead from alloys  4. Amperometric determination of glucose in solution  5. Determination of ion concentration in a solution with an ion-selective electrode | | | | |
| **References**  1. M. V. Šušić, Osnovi elektrohemije i elektrohemijske analize, Belgrade, 1992.  2. S. Mentus, Elektrohemija, Belgrade, 2001.  3. A. Despić, Osnove elektrohemije 2000, Institute for textbooks and teaching aids, Belgrade, 2003.  4. A.J Bard, L.R Faulkner, Electrochemical methods, Fundamentals and Applications, Wiley, 2001. | | | | |
| **Active teaching classes** | **Lectures**  45 | | **Laboratory work**  30 | |
| **Teaching mode**  Lectures and laboratory work | | | | |
| **ASSESSMENT METHODS AND CRITERIA (Max 100 points)** | | | | |
| **Pre exam duties** | **Points** | **Final exam** | | **Points** |
| Activity during lectures | 5 | Written examination | | 10 |
| Practical teaching | 15 | Oral examination | | 30 |
| Teaching colloquia | 40 |  | |  |
| Seminar | - |  | |  |