|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Study program** Applied chemistry with the management basics | | | | |
| **Course title** Advanced physical chemistry course (H250C) | | | | |
| **Name of lecturer/lecturers** Milan N. Mitić | | | | |
| **Type of course** Obligatory | | | | |
| **Number of ECTS allocated** 5 | | | | |
| **Course objectives**  The goal of the course is to provide students with more detailed information about the selected scientific fields of physical chemistry, with an emphasis on current theoretical and practical information in the field of kinetics of electrode process, energy conversion and chemical sensors. | | | | |
| **Course outcomes**  Upon successful completion of this course, students should be able to: differentiate and analyze factors that determine the speed of electrochemical reactions, to distinguish non-renewable from renewable sources and methods of energy conversion, as well as, based on the acquired knowledge about the principles of sensor functioning 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. The molar conductivity of the melt, transport numbers. Solid electrolytes, method of current transfer and transport 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. Butler Follmer equation. I-E curve of a 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 radiation into heat and electricity. Electrochemical energy conversion. Primary and secondary chemical current sources, source power, degree of utilization of active mass. Chemical sensors: properties of sensors, linear area, 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 weak acids dissociation constant in non-aqueous media.  2. Determination of the electrolyte molar conductivity at infinite dilution in non-aqueous environments.  3. Electrolytic separation and determination of copper and lead from alloys.  4. Amperometric determination of glucose in solution.  5. Determination of ion concentration in the solution with an ion-selective electrode. | | | | |
| **References**  1. M. V. Šušić, Osnovi elektrohemije i elektrohemijske analize, Beograd, 1992.  2. S. Mentus, Elektrohemija, Beograd, 2001.  3. A. Despić, Osnove elektrohemije, Zavod za udžbenike i nastavna sredstva, Beograd, 2003.  4. A. J. Bard, L.R. Faulkner, Electrochemical methods, Fundamentals and Applications, Wiley, 2001. | | | | |
| **Active teaching classes** | **Lectures** 60 | | **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 |  |  | |  |