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| **Title and Code** of the subject:  **Analytical chemistry, MTBE7009** | **ECTS Credit Points: 4** |
| **Type** of the subject: **compulsory** / optional | |
| **Ratio of theory and practice: 0/100** (credit%) | |
| **Type and number of classes per semester**: 28 hour(s) lecture and 28 hour(s) practice per **semester**  **Number of teaching hours / week:** 2+2 (lecture and practice) | |
| **Type of exam**: exam / **practical course mark** | |
| **Subject in the curriculum:** **semester 2.** | |
| Preliminary requirements:- | |

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| **Summary of content - theory**: |
| **Course objectives:** The basic objective of the course is to acquaint students with the most important general analytical knowledge required to determine the quality and composition of the food and food ingredients.  **Schedule:**   1. Introduction to analytical chemistry. History of analytics. 2. Basic concepts. Prefixes. Units and standards. Units of measurement. Metric system. 3. SI units, SI supplementary units and SI derived units. 4. Length, weight, time, electric current, thermodynamic temperature, amount of the substance and luminous intensity. 5. Metrology. 6. The errors of an analysis results. 7. The main steps of a multielemental analysis. 8. Calibration method. Standard addition method. Internal standard method. Spiking method. 9. The Fresenius's classification criteria of cations. The Fresenius's classification criteria of anions. 10. The general methods of quantification. 11. The fundamentals of quality assurance of analyses. 12. Classical analysis, titrimetric. Acid-base titrations. Complexometry. 13. Celatometries titration. Precipitation titration. Redox titration. 14. Classical analysis, gravimetry. |
| **Summary of content - practice**: |
| Skills to be learnt: Learning to name and write formulas for chemical compounds. Balancing chemical equations. Balancing redox reactions using oxidation numbers. Concentration calculation. Calculation in acid-base, complexometric and permanganometric titration.   1. Formulas of chemical compounds 2. Balancing chemical equations 3. Balancing redox reactions using oxidation numbers 4. Intruduction of laboratory equipments. Concentration calculation I. 5. Concentration calculation II. 6. Concentration calculation III. 7. Acid-base titration I. 8. Acid-base titration II. 9. Acid-base titration III. 10. Acid-base titration IV. 11. Complexometric titration I. 12. Complexometric titration II. 13. Permanganometric titration I. 14. Permanganometric titration II. |
| **Literature, handbooks in English** |
| 1. Giinzler, H., Williams, A.: 2001. Handbook of Analytical Techniques. WILEY-VCH, Weinheim, Germany. 2. Ebbing, D. D., Gammon, S. D.: 2009. General chemistry. Houghton Mifflin Company. Boston. USA. 3. Danzer, K.: 2007. Analytical chemistry. Theoretical and metrological fundamentals. Springer-Verlag. Berlin Germany. 4. Skoog, D. A., West, D. M., Holler, F. J.: 1992. Fundamentals of Analytical Chemistry. ed. Saunders College Publ. Fort Worth, Texas (USA). |
| **Competencies gained** *(acc. to the Regulation on training and outcome requirements)* |
| 1. **Knowledge:**  * They have to know the basic principles of laboratory examination for the food technology and food safety analysis.  1. **Skills:**  * They have to have the ability to learn laboratory techniques, taking into account the environmental and health protection standards, and applying new methods in the whole area of food production.  1. **Attitude:**  * They have to be committed to food quality, food safety and environmentally friendly solutions that support the health of the individual and society. * They have to receptive to learn the needed theory, in order that they could understand, how the equipments and tools, used in food industry, functions.  1. **Autonomy and responsibility:**  * They should be able to take the responsibility for own work and for the work of their colleagues under their supervision as well. |

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| **Responsible lecturer: Dr. Béla Kovács; Dr. Éva Bacskainé Bódi** |
| **Other lecturer(s): Dr. Diána Ungai, Áron Soós** |
| **Terms of course completion:** |
| 1. Written exam (minimum marks when percentage is 60%) |
| **Form of examination:** |
| Written exam |
| **Requirement(s) to get signature:** |
| Participate in the practices and successful practice tests. |
| **Exam questions:** |
| 1. Please calculate! eg.:   mg/kg=............% (1 points)  ug/g=............ ng/g (1 points)  %=............ μg/g (1 points)  ppb=............ μg/kg (1 points)  ppt=............ ppq (1 points)   1. Write down the definition of these concepts!   - Selectivity (2 points)  - Robustness/ruggedness (2 points)  - Range of measurement (2 points)  - Linearity (2 points)  - Sensitivity (Fig.) (2+2 points)  - Detection limit (Equations) (2+2+2 points)  - Quantitation limit (Equations) (2+2+2 points)  - Accuracy (2 points)  - Precision (2 points)  - Repeatability (2 points)  - Reproducibility (2 points)  - Calibration method (4 points)  - Standard addition method (4 points)  - Internal standard method (4 points)  - Isotope-dilution process (2 points)  - Equivalence point in acid base titration (2 points)  - Coordination number (2 points)  - Gravimetric analysis (2 points)   1. Describe the main steps of the inorganic environmental analysis and estimation of the level of errors for the various steps (10 points) 2. Write down each steps of the sample preparation of the inorganic environmental analysis. (7 points) 3. Could you list the SI base units? (7 points) 4. Could you give me a short history of the International Systems of Units (SI) (10 points) 5. Write down the measurement unit name and the determination of the length! (1 + 3 points) 6. Write down the measurement unit name and the determination of the mass! (1 + 3 points) 7. Write down the measurement unit name and the determination of the time! (1 + 3 points) 8. Write down the measurement unit name and the determination of the electrical current! (1 + 3 points) 9. Write down the measurement unit name and the determination of the thermodynamic temperature! (1 + 3 points) 10. Write down the measurement unit name and the determination of the amount of the substance! (1 + 3 points) 11. Write down the measurement unit name and the determination of the luminous intensity! (1 + 3 points) 12. Could you give me the groups of cations and the characteristics of these groups? (10 points) 13. Could you give me minimum 2-2 examples of the each cation groups? (10 points) 14. Could you give me the groups of anions and the characteristics of these groups? (8 points) 15. Could you give me minimum 2-2 examples of the each anion groups? (8 points) 16. What is metrology? (5 points) 17. Could you give me the three main tasks of the metrology? (3 points) 18. What are categories of metrology (names+descriptions)? (3 + 3 points) 19. What do the scientific metrology deal with (min. 6)? (6 points) 20. Could you write about the Arrhenius (or Classical) acid-base definition? (2 + 2 points) 21. Could you write about the Brønsted-Lowry acid-base definition? (2 + 2 points) 22. Could you write about the Lewis acid-base definition? (2 + 2 points) 23. What is the pH, moreover could you give me an acidic and a basic examples (concentrations of hydronium and hydroxide, furthermore the pH and pOH in those points? (4 + 4 points) 24. Could you write minimum two pH indicators and their pH ranges? (2 + 2 points) 25. What means polyprotic acid and write 2 examples? (2 + 2 points) 26. Could you list the possible 4 classifications of acids-base reactions? (4 points) 27. Could you list the types of titrimetric methods? (4 points) 28. Could you draw a titration curve of a strong acid with a strong base or a strong base with a strong acid? (4 points) 29. Could you write information of complexes and minimum 1-1 examples of unidentate, bidentate and hexadentate ligands? (3 + 3 points) 30. Could you write some information about oxidation reduction reaction? (4 points) 31. Could you write some information about electrochemical cells? (4 points) 32. Could you draw an example of galvanic cell? (6 points) 33. Could you write some information about Nernst equation? (6 points) 34. Could you write some information about precipitation reactions and an example? (2 + 2 points) 35. Could you write some information about precipitation titration? (4 points) 36. Could you write the scheme of the analysis and the main operations of a precipitation gravimetry? (10 points) |