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| **Title** of the subject:  **Instrumental analytics I. (Spectroscopyc methods) MTMEL7008** | **ECTS Credit Points:5** |
| **Type** of the subject: compulsory | |
| **Ratio of theory and practice: 50-50%** | |
| **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 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 knowledge of the most important spectroscopyc methods of the instrumental chemical analytical techniques required to determine the quality and chemical components of food, food raw materials and food ingredients.  1-2.: The simplified diagram of a multielemental chemical analysis  3.: The performance characteristics of analytical methods  4.: UV-VIS absorption spectrophotometry  4.: General description of spectroscopic methods  5-6.: Flame atomic absorption spectrometry (FAAS).  7.: Graphite furnace atomic absorption spectrometry (GF-AAS)  8.: The interference effects of FAAS and GF-AAS techniques and their eliminations  9-10.: Inductively coupled plasma optical emission spectrometry (ICP-OES)  11-12.: Inductively coupled plasma mass spectrometry (ICP-MS)  13.: The interference effects of ICP-OES and ICP-MS techniques and their eliminations  14.: Comparison, evaluation and application of each measurement technics |
| **Summary of content - practice**: |
| Skills to be learnt: Learning to use the most important spectroscopyc methods of the instrumental chemical analytical techniques to determine the quality and components in various samples of food, food raw materials and food ingredients.  1: Preparation and examination of an analytical method  2 and 3: Concentration units, and their conversion  4 and 5: Atomic mass, relative atomic mass, molecular mass  6 and 7: Performance characteristics  8: UV-Vis spectrophotometric method  9: Oxidation numbers  10 and 11: UV-Vis spectrophotometric method  12: Sample preparation for elemental analysis  13: Flame atomic absorption spectrometry  14: Inductively coupled plasma optical emission spectrometry |
| **Literature, handbooks in English** |
| 1. Boss, C. B. & Fredeen, K. J., 1997. Concepts, instrumentation, and techniques in inductively coupled plasma optical emission spectrometry. Perkin Elmer. USA. 2. Cresser, M. S., 1994. Flame spectrometry in environmental chemical analysis. The Royal Society of Chemistry. Cambridge. 3. Montaser, A. & Golightly, D. W., 1987. Inductively coupled plasmas in analytical atomic spectrometry. VCH Publishers. New York. 4. Montaser, A. 1998. Inductively coupled plasmas mass spectrometry. VCH Publishers. New York. 5. Pare J.R.J. and J.M.R. Belanger, 1997. Instrumental methods in food analysis. Environment Canada, Environmental Technology Centre, Ottawa, Ontario, Canada, Elsevier, Amsterdam - Lausanne - New York - Oxford - Shannon - Tokyo. |
| **Competencies gained** *(acc. to the Regulation on training and outcome requirements)* |
| 1. **Knowledge:**  * They have to know the tools and methods in detail used to control food and its production processes.  1. **Skills:**  * They have to have the ability to select appropriate test methods for the entire food chain.  1. **Attitude:**  * They have to be open, motivated and responsive to the knowledge and practical application of modern and innovative procedures, moreover open to paradigm changes in food science and -technology. * They have to be able to recognize the values in the area of food safety and -quality. * They have to be responsive to the use of effective methods and tools.  1. **Autonomy and responsibility:**  * They should be able to take the responsibility for the quality and safety of food produced. |

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| **Responsible lecturer: Prof. Dr. Béla Kovács, professor, PhD** |
| **Other lecturer(s): Dr. Éva Bacskainé Bódi, Áron Soós** |

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| **Terms of course completion:** |
| 1. Completing laboratory exercises 2. Oral exam (2 questions) |
| **Form of examination:** |
| Oral exam |
| **Requirement(s) to get signature:** |
| Participate in the practices and successful practice tests |

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| **Exam questions:** |
| 1. Compare the most important parameters of the FAAS, the GF-AAS, the ICP-OES and the ICP-MS measurement methods. 2. Give details of principles and methods of the atomic absorption spectrometry, as well as the various types, moreover draw and explain the schematic structure of the AAS equipments. Give a list of the possible interference effects and their eliminations. 3. Give details of basic principle and method of the inductively coupled plasma mass spectrometry, as well as the schematic structure of the equipment, moreover the four main types of the interfering effects appearing in ICP-MS technique (interferences and eliminations). 4. Give details of basic principle and method of the inductively coupled plasma optical emission spectrometry, as well as the schematic structure of the equipment, moreover the sample introduction techniques. Give a list about the possible interference effects and their eliminations. 5. The most important performance characteristics of the analytical methods. 6. Give details of the simplified flowchart for inorganic environmental analysis, including a rough error estimation for the different analytical procedures (the detailed examples also). 7. Give details of basic principle and method of the UV-VIS spectrophotometry, as well as the schematic structure of the equipment, moreover the constituents what we can analyse. |