**Teaching/training program in instrumental analysis   
Term:** from **15.07.2019** to **6.09.2019  
Place: The East European state university in Przemyśl (PWSW)**

The course will provide exposure to some instrumental techniques emphasizing practical aspects of chemical analysis for beginners.

The program which forms the foundation of analytical chemistry is compulsory for everyone who is serious about gaining an entry to the industrial laboratories or academic researches. **The program will be beneficial to** students in such disciplines, as:

* Chemistry,
* Food & Nutrition and Agricultural Sciences,
* Environmental Protection.

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| **I. Flame Atomic Absorption (FAAS)** | | *Week* | |
| Training will cover:  Principle and theoretical background of the flame atomization method (repetition).  Practical familiarization with the construction of the GBC / FAAS atomic spectrometer.  Spectrophotometer components: hollow cathode lamp (HCL), cloud chamber with slit burner.  Notes on components maintenance and equipment cleaning. Installation and positioning of the slit burner.  Getting to know the spectrometer software for the flame method (English version).  Start-up notes. Safety precautions for running of the AA spectrophotometer.  Notes on the working gases purity, pressure settings, flame composition and optimization.  Safe shutdown and restoration of the equipment.  Practical aspects of the measurement:  Sample preparation for the FAAS method.  Calibration. Linear and nonlinear calibration models in action.  Collecting and presentation of the results. Range of linearity, limit of detection and limit of quantification. | | **1-2**  *(15.07.2019-26.07.2019)* | |
| *expected hours to be implemented* | | **35** |

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| **II. Graphite Furnace Atomic Absorption Spectrophotometry (GFAAS)** | | *Week* |
| Training will cover:  Principle and theoretical background of the electro-thermal atomization method (repetition).  Installation of the AAS - GBC auto sampler. Positioning of the auto sampler before measurement.  Practical aspects of operation, cleaning and maintenance of the measuring system.  Construction and operation of the graphite furnace – technical details. Graphite cuvette installation and furnace chamber cleaning.  GBC software for the electro thermal (ETH) method.  The graphite furnace heating program, programming and modification of GF operational parameters.  Programming the auto sampler. Sample queue and automatic sample dilution.  Practical aspects of sample preparation for GFAAS analysis, mineralization and pre-concentration of samples. Safety precautions for starting and stopping the GFAA spectrophotometer.  As part of the internship, students will be involved in the work on the determination of trace amounts of selected heavy metals in water. | | **2-3**  *(29.07.2019-10.08.2019)* |
| *expected hours to be implemented* | **35** |

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| **III. High Performance Liquid Chromatography (HPLC)** | | *Week* |
| Training will cover:  Principles of operation and construction - main components of the Agilent 1200 HPLC chromatograph: pump, degasser, autosampler column and detector.  Normal and reverse phase chromatography. General rules for column and eluent selection for different types of analytes. Isocratic and gradient analysis. Purity of reagents used in HPLC analysis.  Introduction to ChemStation software (Agilent Technologies).  Creation and modification of methodologies for determination based on literature (scientific papers). Autosampler programming, selection of equipment parameters, remarks on optimization of the determination process. Creating a sequence of analyzes, short introduction to multi-level calibration.  Starting the HPLC chromatograph. Measuring and interpreting the results  The most common problems with an HPLC system. Troubleshooting.  Students will be involved in sample preparation and SPME microextraction/direct immersion of test analytes. | | **5-6**  *(12.08.2019-23.08.2019)* |
| *expected hours to be implemented* | **35** |

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| **IV. Gas chromatography (GC)** | | *Week* | |
| Training will cover:  Principles of gas chromatography. Main components of the Agilent GC 6920 system: autosampler, injection port, capillary column, column oven, FID detector.  Type of analytes suitable for GC analysis. Purity of reagents, purity of working gases.  Agilent software (Chemstation) for GC method.  Working with gas chromatography. Selection of determination parameters, programming of GC autosampler. Ensuring optimal working conditions of the column, preparation and cleaning of the capillary column. Safety rules while working with capillary column, injection port and column oven.  The most common problems with GC system. Troubleshooting  Basic principles of LLE extraction and preparation of samples for GC analysis  Analysis and interpretation of the results | | **7-8**  *(26.08.2019-6.09.2019)* | |
| *expected hours to be implemented* | | **35** |