Annex No. 5

to Ordinance No. 21/2019

**COURSE/MODULE SYLLABUS FOR UNIVERSITY COURSES/PhD STUDIES**

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|  | Course/module name in Polish and English  Stable isotopes forensics and food authenticity/Badania izotopowe w technikach śledczych i testach autentyczności żywności | | |
|  | Discipline  Earth and Environmental Science | | |
|  | Language of instruction  English | | |
|  | Teaching unit  Faculty of Earth Science and Environmental Management, Institute of Geological Sciences, Department of Experimental Petrology | | |
|  | Course/module code  USOS | | |
|  | Type of course/module *(mandatory or optional)*  optional | | |
|  | Field of studies (major, if applicable)  Geology (spec. Applied Geoscience) | | |
|  | Level of higher education *(undergraduate (I cycle), Master’s (II cycle), 5 year uniform Master’s studies)*  Master’s (II cycle) | | |
|  | Year of studies *(if applicable*)  II | | |
|  | Semester *(winter or summer)*  winter | | |
|  | Form of classes and number of hours  Lectures: 14  Teaching methods  Multimedia lecture. | | |
|  | Name, title/degree of the teacher/instructor  Coordinator: Dr hab. Maciej Górka, Prof. UWr  Lecturer: Dr hab. Maciej Górka, Prof. UWr | | |
|  | Course/module prerequisites, in terms of knowledge, skills, social competences  Basic knowledge and skills in analytics, chemistry and geochemistry | | |
|  | Course objectives  To introduce students with knowledge on: variation of the isotopic composition and fractionation processes of light elements O, H , S , C, N in nature ; instrumental and analytical methods; sample preparation for isotopic ratio analysis ; the use of isotope techniques in the study of forensics , food authenticity , sports doping , the origin of the population, etc. | | |
|  | Course content  1. Definition of mass spectrometry, areas of application, basic general diagram of the mass spectrometer, sample preparation methods for the measurement of isotopic ratios (off-line and on-line), isotopic standards, calibrations etc.  2. The isotopic composition (S, C, H, N, O) of selected substances occurring in nature.  3. The use of isotope techniques in distinguishing drugs: (i) natural and semi-synthetic (marijuana, morphine / heroin, cocaine) and synthetic (MDMA-methylenedioxymethamphetamine, methamphetamine)  4. The application of isotope techniques in distinguishing explosives and their precursors: ammonium nitrate, hexamine, cyclotrimethylenetrinitramine (RDX), Sentex, Perchlorate, Tetranitrate Pentaerythritol tetranitrate (PETN), Trinitrotoluene (TNT), High Melting Point Explosive (HMX) and Ammonium nitrate and fuel oil (ANFO).  5. The use of isotope techniques in tracing the origin of the population: geographical variation of the isotopic composition of human tissues, bones and hair (record of the history of life), the investigative archaeological research etc.  6. The use of isotope techniques in the study of various substances in investigative techniques and crime: traces of microbiological testing of materials from the crime scene (e.g. paper, plastic, adhesive films, matches etc.)  7. The use of isotope techniques in testing the authenticity of the food:  (I) alcohols (pure ethanol, wine, whiskey, tequila, beer, etc.);  (Ii) cheeses and dairy products;  (Iii) the meat and fish;  (Iv) high-quality natural oil, honey, spices;  (V) pharmaceutical products and medicines.  8. The use of isotope techniques in studies of anti-doping and the service of the "purity" of sports. | | |
|  | Intended learning outcomes  P\_W01 Knows the idea of mass spectrometry, sample preparation for analysis of isotopic ratios, etc.  P\_W02 knows how to use isotope techniques for solving problems related to the study investigators, food authenticity testing and forensic research.  P\_U01 uses the technique of mass spectrometry in forensics, crime and tracers investigations.  P\_K01 is aware of the role and importance of modern isotope analytical techniques.  P\_K02 is capable of reliable preparing samples for isotopic analyses and understands the social responsibility resulting from presented on the basis of the results, reports and conclusions. | Symbols of learning outcomes for particular fields of studies, *e.g. K\_W01\**, *K\_U05,K\_K03*  K\_W02, K\_W03, K\_W06, K\_W08, K\_W09  K\_W02, K\_W03, K\_W06, K\_W08, K\_W09  K\_U01, K\_U02, K\_U05  K\_K01, K\_K06  K\_K01, K\_K06 | |
|  | Required and recommended reading *(sources, studies, manuals, etc.)*  Required reading  Meier-Augenstein W., Stable isotopes forensics, Wiley-Blackwell, 2010  Barker J., Mass spectrometry (Second edition), John Wiley & Sons, Chichester New York Brisbane Singapore Toronto, 1999  Hoefs J., Stable Isotope Geochemistry, Springer-Verlag, Berlin Heidelberg 2009  De Groot P.A., Handbook of Stable Isotope Analytical Techniques, Elsevier, 2004  Publications from Scopus, ISI Web etc. (available to the teacher ) e.g.:  Benson S. , Lennard C., Maynard P., Roux C., 2006, Forensic applications of isotope ratio mass spectrometry - A review. Forensic Science International, 157(1): 1-22  Ghidini S, Ianieri A, Zanardi E, Conter M, Boschetti T, Iacumin P, Bracchi PG, 2006, Stable isotopes determination in food authentication: A review. Ann Fac Medic Vet Univ Parma, (XXVI 2006):193-204.  Ehleringer J.R., Cooper D.A., Lott M.J., Cook C.S., 1999, Geo-location of heroin and cocaine by stable isotope ratios. Forensic Science International, 106: 27–35  Widory, D., Minet, J.J., Barbe-Le Borgne, M. 2009. Fingerprinting explosives: A multi-isotope approach. Science & Justice, 49: 62-72.  Ehleringer, J. R., Bowen, G. J., Chesson, L. A., West, A. G., Podlesak, D. W. and Cerling, T. E., 2008, Hydrogen and oxygen isotope ratios in human hair are related to geography. Proc. Natl. Acad. Sci USA, 105: 2788-2793  Jahren, A. H.; Kraft, R. A., 2008, Carbon and nitrogen stable isotopes in fast food: Signatures of corn and confinement. Proc. Natl. Acad. Sci. USA , 105: 17855-17860.  Martinelli L.A., Nardoto G.B., Chesson L.A., Rinaldi F.D., Ometto J.P, Cerling T.E., Ehleringer J.R., 2011, Worldwide stable carbon and nitrogen isotopes of Big Mac® patties: An example of a truly “glocal” food, Food Chemistry, 127(4): 1712-1718  L.A. Martinelli, M.Z. Moreira, J.P.H.B. Ometto, A.R. Alcarde, L.A. Rizzon, E. Stange et al., 2003, Stable carbon isotopic composition of the wine and CO2 bubbles of sparkling wines: Detecting C-4 sugar additions. Journal of Agricultural and Food Chemistry, 51: 2625–2631  Drivelos S.A., Georgiou C.A., 2012, Multi-element and multi-isotope-ratio analysis to determine the geographical origin of foods in the European Union, TrAC Trends in Analytical Chemistry, 40: 38-51  Cawley AT, Trout GJ, Kazlauskas R, Howe CJ, George AV., 2009, Carbon isotope ratio δ13C values of urinary steroids for doping control in sport. Steroids, 74(3): 379-92 | | |
|  | Assessment methods for the intended learning outcomes:  Written test. K\_W02, K\_W03, K\_W06, K\_W08, K\_W09, K\_U01, K\_U02, K\_U05, K\_K01, K\_K06. | | |
|  | Credit requirements for individual components of the course/module:  Lectures:  - open test (in English): 6 of 10 possible points for note 3.0 | | |
|  | Total student effort | | |
| form of student activities | | number of hours for the implementation of activities |
| classes (according to the plan of studies) with a teacher/instructor:  - lectures: 14  - consultations: 11 | | 25 |
| student's own work (including group-work) such as:  - being prepared for classes: 3  - reading the suggested literature: 10  - preparing for tests: 12 | | 25 |
| Total number of hours | | 50 |
| Number of ECTS credits | | 2 |