

Course title	APPLICATION OF ISOTOPIC METHODS						
Code	ZDIK30						
Study	Postgraduate Interdisciplinary University Doctoral Study Environmental Protection and Nature Conservation						
Semester	II						
ECTS	5						
Course state	elective						
Professors	Jadranka Barešić, PhD, senior research associate						
Colaborators							
Entrance conditions							
Aim	Introduction to isotopic geochemistry and application of isotopic methods as complementary methods in different scientific research areas						
Learning outcomes	Knowledge on isotopic methods and possibilities of their application, capability of planning and conducting comprehensive environmental study.						
Connections between students activity, learning outcomes and evaluation	Students activity	ECTS	Learning outcomes	Course activity	Evaluation methods	Points*	
						min	max
	Class attendance		Methods knowledge	Teaching	Student's signature	0	1
	Research and seminar preparation		Research independence	Consultation	Mark on seminar work	0	5
	Total	5					5
Consultations	By e-mail, telephone, meetings if necessary						
Teaching form	Lectures			Seminars		Exercises	
No. of hours	5			5		5	
Content	Isotopic effects (principles, thermodynamic equilibrium, kinetic fractionation); Stable isotopes (basic definitions, standards, measurements); Carbon cycle in the atmosphere and in plants; Distribution of stable isotopes (² H and ¹⁸ O) in water cycle; Radioactive isotopes (basic concepts, measurement methods); Tritium (global distribution, sampling, standards, measurements); Radioactive carbon (¹⁴ C) (global distribution, ¹⁴ C in organic material, dating methods, reservoir effects); Other isotopic dating methods in geology, palaeontology and archaeology; Isotopes in ecological, diet, and paleotemperature studies; Isotopes as geochemical and environmental tracers; Overview of isotope application in hydrogeology, agriculture, life sciences and engineering; Case studies						
Compulsory literature	<ol style="list-style-type: none"> 1. Barešić, J.: Radiocarbon dating: PPT IJS, Ljubljana (December 2015) 2. http://www.irb.hr/eng/Research/Divisions/Division-of-Experimental-Physics/Laboratory-for-Low-level-Radioactivities 3. Michener, R., Lajtha, K. (2007): Stable Isotopes in ecology and Environmental Science, Blakwell Publishing p. 566. 4. Faure, G., Mensing, T.M. (2005): Isotopes: Principles and Applications, Wiley, p. 897 						
Optional literature	<ol style="list-style-type: none"> 1. D. Srdoč, N. Horvatinčić, B. Obelić, I. Krajcar, A. Sliepčević: Procesi taloženja kalcita u krškim vodama s posebnim osvrtom na Plitvička jezera; Carsus Iugoslaviae, 11/4-6 (1985), p.101-204. 2. Tykva, R., Berg, D. (2004): Man-made and natural Radioactivity in Environmental Pollution and Radiochronology. Kluwer Academic Publishing. p: 416 						

	<ul style="list-style-type: none"> 3. Leng, M. J. (2006): Isotopes in paleoenvironmental research, Springer, p. 306. 4. Walker, M. (2005): Quaternary dating methods. Wiley. P. 285 5. T. Higham, T., Petchey, F. (2000): Radiocarbon Dating in Archaeology; Methods and applications. In: Radiation in Art and Archaeometry (D.C.Creagh & D.A.Bradley, eds.), Elsevier, Amsterdam
Completion condition	Class attendance
Exam form	Seminar paper, oral
Possible teaching languages	Croatian, English
Form of quality monitoring	Student questionnaire upon completing of class