UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	Geookolje in geomateriali
Course title:	Geoenvironment and Geomaterials

Študijski programi in stopnja	**Študijska smer**	**Letnik**	**Semestri**
Geologija, druga stopnja, magistrski	Ni členitve (študijski program)	1. letnik	Zimski

Univerzitetna koda predmeta/University course code: 718

Predavanja	**Seminar**	**Vaje**	**Klinične vaje**	**Druge oblike študija**	**Samostojno delo**	**ECTS**
75	15	60	0	0	150	10

Nosilec predmeta/Lecturer: Matej Dolenec, Nina Zupančič

Vrsta predmeta/Course type: Obvezni / Compulsory

Jeziki/Languages:		
	Predavanja/Lectures:	Angleščina, Slovenščina
	Vaje/Tutorial:	Angleščina, Slovenščina

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	**Prerequisites:**
Zaključen dodiplomski študij, osnovna računalniška pismenost.	Completed undergraduate study, basic computer literacy.

Vsebina:	**Content (Syllabus outline):**
Izotopska geokemija: - Mehanizmi in procesi frakcioancije in razpada stabilnih in radioaktivnih izotopov. - Spremenljivost razmerij stabilnih izotopov v naravi (O, H, C, S, N) - kozmični material, litosfera, hidrosfera, biosfera, atmosfera. - Stabilni izotopi H, B, Li, Si, Cl, O, C, N, S ter njihova frakcionacija na Zemlji v različnih medijih - reševanje konkretnih primerov. - Geotermometrija. - Geokemične lastnosti dolgoživečih in kratkoživečih radioaktivnih izotopov pri nastanku in transportu sedimentnih, magmatskih in metamorfnih kamnin, vodi in sedimentu ter oceanih. - Geokemija radioaktivnih izotopov v kamninah, tleh in vodi. - Najpomembnejši izotopski geokronometri: K-Ar (and Ar-Ar), Rb-Sr, U(Th)-Pb, Sm-Nd... - Delo v laboratoriju: priprava in merjenje vzorcev za izotopsko analizo Ckarb., Corg, O, S (SO4, AVS, CRS), priprava in merjenje vzorcev za elementno analizo HCONS. - Ionizirajoča sevanja: fizikalne osnove, detekcija, biološki učinki, značilne doze, osnove o predpisih, radioaktivni odpadki, viri sevanja v industriji, varstvo pred sevanji pri	Isotope geochemistry: - Stable and radioactive Isotope fractionation processes - Variations of stable isotope ration in nature (O, H, C, S, N) – extra-terrestrial materials, lithosphere, hydrosphere, biosphere, atmosphere. - Stable isotopes H, B, Li, Si, Cl, O, C, N, S and their fractionation in Earth systems – practical problems - Isotope geothermometers - Long and short-lived radionuclides geochemical properties in the formation and transport of sedimentary, igneous and metamorphic rocks, water, sediments and oceans. - Geochemistry of radionuclides in rocks, soils and water - The most important isotope geochronometers: K-Ar (and Ar-Ar), Rb-Sr, U(Th)-Pb, Sm-Nd... - Laboratory work: preparation and measurement of sample for isotope and elemental analysis of Ccarb, Corg, O, S (SO4, AVS, CRS), CHNOS. - Ionising radiation: physical basics, detection, biological effects, permissible dose, radioactive waste, radiation sources in industry, radiation protection for X-ray analytical devices (XRD and XRf), external radiations,… Natural abiotic resources: - Need for natural metallic, non-metallic and energy resources and the knowledge of their extraction and

rentgenskih analitičnih napravah, zaščita pred zunanjim sevanjem... Naravni abiološki viri: - Potreba po naravnih kovinskih, nekovinskih in energetskih virov in znanje njihovega pridobivanja in predelave kot gonilo razvoja civilizacije. - Način njihove uporabe in recikliranja kot mera tehnološkega in trajnostnega razvoja. - Nebnovljivi, obnovljivi in alternativni viri energije, njihova uporaba, prednosti in slabosti. - Vrste nekovinskih in kovinskih naravnih surovin, obseg proizvodnje in njihov pomen za človekov obstoj in tehnološki razvoj. - Vpliv pridobivanja kovinskih, nekovinskih in energetskih virov na lokalno, regionalno in globalno življenjsko okolje. - Zgodovina uporabe določenih ključnih materialov in njihova proizvodnje, recentno stanje in projekcija razvoja na okolje. - Neobhodna uporaba izhodiščnih elementov trajnostnega razvoja v načrtovanju geološkega raziskovanja in rudarske proizvodnje ter čimprejša postopna uvedba nujnih sprememb načinov rudarske proizvodnje in opuščanje okolju in zdravju škodljivih. - Začasne, stalne in potencialno katastrofalne posledice pridobivanja naravnih virov na okolje, - Historična, recentna in bodoča odlagališča smeti in rudarske jalovine. - Naravne in zaradi človekovega nezadostnega znanja povzročene katastrofe. - Kvantitativna opredelitev okoljskih onesnaženj. Naravne in antopogene anomalije ter njihov vpliv na okolje in zdravje človeka. - Aktualni problemi in aplikacije ter vizije razvoja. Statistične metode: - multivariatne porazdelitve – normalna porazdelitev - multivartiatna analiza variance - PCA in faktorska analiza tipa R in Q - diskriminantna analiza - clusteraske analize (hierarhična, k-mean) - grafične predstavitve multivariatnih podatkov - obdelava časovnih vrst - obdelava prostorskih podatkov – krigiranje - numerične metode – nekateri sodobni pristopi (nevronske mreže, fuzzy logic)	processing as a driver of development of civilization. - The manner of use and recycling as a measure of technological and sustainable development. - Non-renewable, renewable and alternative energy sources and their use, advantages and disadvantages. - Types of non-metallic and metallic natural raw materials, production volume and their importance to human existence and technological development. - The impact of the metal, non-metal and energy resources on the local, regional and global living environment. - History of the use of selected key materials and their production, recent status and projection of their development on the environment. - Critical uses of baseline elements for sustainable development in the planning of geological exploration and mining production and ASAP introduction of necessary changes in methodology of mining production and the abandonment of ones, which are are harmful to the environment and to health. - Temporary, permanent and potentially catastrophic consequences of extraction of natural resources on the environment. - Historical, recent and future deponies/landfills of human waste and mining waste. - Natural disasters and disasters induced by human due to lack of knowledge. - Quantification of environmental pollution. Natural and antopogenic anomalies and their impact on the environment and human health. - Current problems and applications development vision. Statistical methods: - Multivariate distributions – normal distribution - Multivariate analysis of variance - PCA and Factor analysis of R and Q mode - Discriminant analysis - Cluster analysis (hierarchical, k-mean) - Graphical presentation of multivariate data - Analyses of time series - Analyses of spatial data – kriging - Numerical methods – some up-to-date methods (neuron networks, fuzzy logic)

Temeljna literatura in viri/Readings:

Izbrana poglavja iz knjig:
HOEFS, J., 1997, Stable Isotope Geochemistry, Springer, 201 pp., Berlin.
FAURE & T. M. Mensing: Isotopes - Principles and applications 3th Edition. J.W & SONS, INC, New Jersey, 2005, 928 pp.
DICKIN, A. P., 1995: Radiogenic Isotope Geology, Cambridge University Press, 492 pp., Cambridge.
de SA, M. & JOAQUIM P. 2007: Applied Statistics Using SPSS, STATISTICA, MATLAB and R. Springer, 506 pp.
SWAN, A. R. H. & SANDILANDS, M. 1995: Introduction to geological data analysis. Blackwell Science, 446 pp., Oxford.
CRAIG, J. R., VAUGHAN, D. J., SKINNER, B. J., 2001: Resources of the Earth. Origin, Use, and Environmental Impact. Prentice-Hall, Inc., 520 pp.
APPELO, C. A. J., POSTMA, D., 2005, Geochemistry, Groundwater and Pollution. 2nd ed. Taylor and Francis, 649 str.
KIERAN D. O'HARA, 2014, Earth Resources and Environmental Impacts. 1st ed. Wiley 560 pp.

Cilji in kompetence:

Objectives and competences:

CILJI: Študent pridobi znanje nekaterih kemijskih in statističnih metod, potrebnih za analizo geoloških materialov in prostora. Predmet združuje izotopsko geokemijo, osnove upravljanja z naravnimi in energetskimi viri ter nadgradnjo uporabe statistike v geologiji. Seznani se s principi datacije z različnimi radioaktivnimi izotopi ter z uporabo stabilnih izotopov pri ugotavljanju okolja in pogojev nastanka različnih geoloških materialov. Osvoji znanje o geoloških naravnih in energetskih virih, prednosti in slabosti njihove uporabe ter vplive njihovega izkoriščanja na okolje. Zna kvalitativno in kvantitativno predvideti posledice okoljskih onesnaženj. Številčno obsežne multivariatne podatke z različnih področij geologije zna obravnavati z ustreznimi statističnimi in numeričnimi metodami. KOMPETENCE: Pri reševanju geoloških problemov je sposoben vključiti ustrezne izotopske analize. Sposobnost predvidevanja in reševanja okoljskih posledic pri izkoriščanju in uporabi naravnih in energetskih virov, poznavanje okoljske zakonodaje. Za reševanje problemov zna izbrati in pri interpretaciji uporabiti statistične tehnike.	OBJECTIVES: Student acquires knowledge of selected chemical and statistical methods, necessary to analyse geological materials and environment. Subject merges isotopic geochemistry, basic principles of natural and energy resources management and upgrade of use of statistics in geology. Student gets familiar with principles of radioactive isotope dating and use of stable isotopes for establishing environment and conditions of formation of different geological materials. Acquires knowledge about geological natural and energy sources, advantages and disadvantages of their use and influence on the environment. He is able to qualitatively and quantitatively predict consequences of environmental pollution. He can deal with large multivariate data from different fields of geology with appropriate statistical and numerical methods. COMPETENCES: Student is able to include the appropriate isotopic analysis in solving geological problems. Ability to anticipate and resolve environmental influences caused by exploitation and use of natural resources and energy, knowledge of environmental legislation. Student can select and use statistical techniques for interpretation of problems.

Predvideni študijski rezultati:	**Intended learning outcomes:**
Študent razume nastanek in frakcionacijo izotopov. Razume prednosti in slabosti posameznih virov ter pozna vplive izkoriščanja teh virov na okolje. Zna kvalitativno in kvantitativno opredeliti okoljska onesnaženja. Zna pridobiti numerične multivariatne podatke, razume sistem njihovega zajema, obdelave in interpretacije.	Student understands origin and fractionation of isotopes. Understands the advantages and disadvantages of different sources and knows the effects of the exploitation of these resources on the environment. He is able to qualitatively and quantitatively identify the environmental pollution. Knows how to obtain a numerical multivariate data, understands systems of their sampling, processing and interpretation.

Metode poučevanja in učenja:	**Learning and teaching methods:**
Predavanja, vaje v laboratoriju in računalniški učilnici, samostojno reševanje problema v obliki seminarske naloge.	Lectures, laboratory work and work with computers, independent resolving of the problem in the form of the seminar work.

Načini ocenjevanja:	**Delež/Weight**	**Assessment:**
Pisni izpit	60,00 %	Written exam
Samostojno izdelane naloge	40,00 %	Independent seminar work
Ocena je vedno sestavljena po tretjinah iz vsakega od področij, ki jih zajema predmet. Ocenjevalna lestvica: (6-10) pozitivno, ob upoštevanju Statuta UL in fakultetnih pravil.		Assessment is always composed of thirds of each areas covered by the subject. Grades: (6-10) positive assessment, according to University Statute and Faculty Acts.

Reference nosilca/Lecturer's references:

SKOBE, Simona, MANIATIS, Yannis, DOTSIKA, E., TAMBAKOPOULOS, D., ZUPANČIČ, Nina. Scientific charaterization of the Pohorje marbles, Slovenia, Archaeometry 52, 2010, str. 177-190.
ZUPANČIČ, Nina, SKOBE, Simona. Anthropogenic environmental impact in the Mediterranean coastal area of Koper/Capodistria, Slovenia. Journal of soils and sediments, 2013, 11 str.
ZUPANČIČ, Nina. The influence of vegetation type on metal content in soils. RMZ-mater. geoenviron., 2012, 59, str. 229-244.
DOLENEC, Matej, SERAFIMOVSKI, Todor, DANEU, Nina, DOLENEC, Tadej, ROGAN ŠMUC, Nastja, VRHOVNIK, Petra, LOJEN, Sonja. The case of the carbonatite-like dyke of the Madenska River complex at the Kriva Lakavica section in the

Republic of Macedonia : oxygen and carbon isotopic constraints. Turkish journal of earth sciences, ISSN 1300-0985, 2015, vol. 24, no. 6, str. 627-639
DOLENEC, Matej, OGORELEC, Bojan. Organic carbon isotope variability across the P/Tr boundary in the Idrijca Valley section (Slovenia : a high resolution study = Variabilnost izotopske sestave organskega ogljika na permsko-triasni meji v dolini Idrijce : detajlna študija. Geologija, ISSN 0016-7789. [Tiskana izd.], 2001, let. 44, 2, str. 331-340.
DOLENEC, Matej, ŽVAB ROŽIČ, Petra, MIHELČIĆ, Goran, LAMBAŠA, Živana, LOJEN, Sonja, KNIEWALD, Goran, DOLENEC, Tadej, ROGAN ŠMUC, Nastja. Use of stable nitrogen isotope signatures of anthropogenic organic matter in the coastal environment: a case study of the Kosirina Bay (Murter Island, Croatia). Geologia Croatica, ISSN 1330-030X, 2011, vol. 64, no. 2, str. 143-152.