Univerza v Mariboru

Fakulteta za naravoslovje in matematiko

UČNI NAČRT PREDMETA / COURSE SYLLABUS	
Predmet:	**Uvod v znanstvenoraziskovalno delo**
Course title:	**Introduction to scientific research work**

Študijski program in stopnja Study programme and level	Študijska smer Study field	Letnik Academic year	Semester Semester
Doktorski študij Ekološke znanosti, 3. stopnja		**1.; 1st**	**1.; 1st**
Doctoral Study Ecological Sciences, 3rd degree			

Vrsta predmeta / Course type	Obvezni/obligatory
Univerzitetna koda predmeta / University course code:	

Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Lab. vaje Laboratory work	Terenske vaje Field work	Samost. delo Individ. work	ECTS
15	**45**				**120**	**6**

Nosilec predmeta / Lecturer:	Andrej ŠORGO

Jeziki / Languages: **Predavanja / Lectures:**	slovenski / Slovene
Vaje / Tutorial:	slovenski / Slovene

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	Prerequisits:
/	/

Vsebina:	Content (Syllabus outline):
Doktorski študent in mentor, naloge študenta in mentorja, postopek in zahteve za pridobitev doktorata znanosti na UM. Osnovni principi in načela znanstvenega dela, raziskovanja in komunikaciranja. Faze raziskovalnega dela: 1: opredelitev in oblikovanje raziskovalnega	PhD student and mentor, duties of students and mentors, procedure and requirements for obtaining PhD at UM. Fundamental principles of scientific work, research and communication. Phases of research work: 1: definition and articulation of research aims,

problema, namena in ciljev raziskave; - oblikovanje raziskovalnih vprašanj; - oblikovanje hipotez; - definiranje informacij / podatkov potrebnih za raziskavo. 2: lokacija in dostop do informacij / podatkov; - vrste podatkov / informacij; - iskalne strategije v akademskih podatkovnih bazah; - iskalne strategije v digitalnih okoljih; - načela zbiranja podatkov (vzorčenja; opazovanja; meritve; eksperimenti; zgodovinska metoda; terensko delo). 3: ocena informacij / podatkov - kvalitativni in kvantitativni kriteriji za ocenjevanje podatkov / informacij; - kompilacija podatkov in identifikacija spremenljivk; - znanstveni pregled. 4: organizacija informacij / podatkov - načela opisne statistike odvisnih in neodvisnih spremenljivk; - predstavitev podatkov / informacij: slike, grafi, preglednice, tekst 5: uporaba informacij / podatkov - načela interpretacije podatkov / informacij; - uporaba linearnih in posplošenih linearnih modelov; - univariatne in multivariatne statistike; - klasifikacije in ordinacije; - znanstvena razprava; - oblikovanje sklepov; 6: komunikacija in etična uporaba informacij; - etika raziskovalnega dela; - etika objave (plagiat; avtorstvo) - oblike profesionalne predstavitve; - znanstveno pisanje - pravila. - ustne predstavitve. Temeljne in specifične znanstveno raziskovalne metode in programi v biologiji in ekologiji: - ANOVA, ANCOVA, MANOVA, Poisson	goals, and objectives. - formulation of research questions; - formulation of hypotheses; - definition and articulation of information/data need. 2: location and access of information/data; - types of data/information; - search strategies in academic databases; - search strategies in digital environments; - principles of data collection (sampling; observation; measurements; experiment; historical method; field-work). 3: assessment of information/data - quality and quantitative criteria for data/informaton assessment; - compilation of data and identification of variables; - scientific review. 4: organisation of information/data - principles of descriptive statistics of dependent and independent variables; - data/information presentation figures, tables, text 5: use of information/data - principles of data/information interpretation; - linear and generalized linear models; - univariate and multivariate statistics; - classifications and ordinations; - scientific discussion; - formulation of conclusions; 6: communication and ethical use of information; - ethics of research work; - ethics of publication (plagiarism; authorship) - forms of professional presentations; - scientific writing as a genre – it's rules. - oral presentations. Fundamental and specific scientific methods and software in biology and ecology: • ANOVA, ANCOVA, MANOVA, Poisson and Logistic Regression, PCA, DCA, CCA with the use of programs R, Canoco, TWINSPAN;

regresija, Logistična regresija, PCA, DCA, CCA z uporabo R, Canoco, TWINSPAN - povezava relacijskih podatkovnih zbirk z prostorskimi podatkovnimi bazami (uporaba SQL ukazov, geodatabase, shape itd.) - analiza podob - poznavanje in uporaba nacionalnih in globalnih podatkovnih baz daljinskega zaznavanja (LANDSAT, IKONOS, MODIS, ESA CCI, LIDAR, itd.) - osnove prostorske analize in prostorskega modeliranja - uporaba obstoječih prostorskih orodij (Arc, FragSTAT, TerrSet, Global Mapper, R) - teoretični principi in orodja za obdelavo nukleotidnih in proteinskih zaporedij za izračun njihovih podobnosti in filogenetskih odnosov med organizmi	• Combining un-spatial and spatial databases (SQL rules, creating geodatabase and shape formats) • Image analysis – knowledge and use of national, regional and global remote sensing databases (LANDSAT, IKONOS, MODIS, ESA CCI, LIDAR, ...) • Basics of spatial analysis and environmental modeling (ArcGIS, FragSTAT, TerrSet, Global Mapper, R,…) • Theoretical principles and tools for the analysis of nucleotide and protein sequences for calculating their similarity and phylogenetic relationships among organisms

Temeljni literatura in viri / Readings:

Doumont, J., ed. *English Communication for Scientists*. Cambridge, MA: NPG Education, 2010.
Gauch, Hugh G. *Scientific method in practice*. Cambridge University Press, 2003.
Lesk A.M. 2014. Introduction to Bioinformatics. Oxford University Press, Oxford, United Kingdom, 400 str.
Šmilauer, Petr, and Jan Lepš. Multivariate analysis of ecological data using CANOCO 5. Cambridge university press, 2014.
Braak, C. J. F., & Šmilauer, P. (2012). CANOCO reference manual and user's guide: software for ordination (version 5.0). Ithaca: Biometris.

Cilji in kompetence:	**Objectives and competences:**
Po opravljenem predmetu bo študent sposoben: - uporabiti načela raziskovalnega dela; - uporabiti načela zbiranja, selekcije, organizacije, analize, ovrednotenja in predstavitve podatkov/informacij; - uporabiti načela etičnega dela na področju raziskav in objav; - uporabiti nekatere specifične metode in orodja raziskovanja v biologiji in ekologiji.	After completion of the course students should be able to: - apply priciples of research work; - apply principles of data/information collection, selection, organization; analysis, assesment and presentation; - apply principles of ethical work in research and publication of it; - use some specific research methods and tools in biology and ecology.
Predvideni študijski rezultati:	**Intended learning outcomes:**

Znanje in razumevanje: Po opravljenem predmetu bi moral biti študent sposoben opisati in zagovarjati pomen načel in splošnih pravil: - raziskovalnega dela; - zbiranja, selekcije, organizacije, analize, vrednotenja in predstavitve podatkov / informacij; - etičnega dela na področju raziskav in objav; - raziskovalnih metod v biologiji in ekologiji. **Prenesljive/ključne spretnosti in drugi atributi:** Po opravljenem predmetu bi moral biti študent sposoben: - načrtovati, izvesti in poročati o svojem raziskovalnem delu v okviru svoje raziskovalne discipline; - razumeti načela in splošna pravila raziskovalnega dela zunaj primarnega raziskovalnega področja.	**Knowledge and understanding:** After completion of the course students should be able to describe importance and defend principles and general rules of : - research work; - data/information collection, selection, organization, analysis, assesment and presentation; - ethical work in research and publication of it. **Transferable/Key Skills and other attributes:** After completion of the course students should be: -able to plan, conduct, and report their research work in the context of the research discipline; - understand principles and general rules of research work outside their primary research field.

Metode poučevanja in učenja:	**Learning and teaching methods:**
• Predavanja, seminar	• Lectures, seminar work

Načini ocenjevanja:	Delež (v %) / Weight (in %)	**Assessment:**
Predstavitev seminarskega dela kot: - kratek znanstveni (strokovni) članek, - spremljujoč plakat, - zagovor dela kot kratka ustna predstavitev. Se oceni z opravil / ni opravil.	 - 50% - 25% - 25%	Presentation of the seminar work as: - short scientific (professional) paper; - accompanying poster; - defence of the work as a short oral presentation. Pass / fail evaluation.

Reference nosilca / Lecturer's references:

Reference habilitiranih nosilcev predmetov v programu / References of lecturers listed in the program