UČNI NAČRT PREDMETA / COURSE SYLLABUS (leto / year 2017/18)			
Predmet:	Kombinatorika		
Course title:	Combinatorics		

Študijski program in stopnja **Study programme and level**	**Študijska smer** **Study field**	**Letnik** **Academic year**	**Semester** **Semester**
Magistrski študijski program Finančna matematika	ni smeri	1 ali 2	prvi ali drugi
Master's study programme Financial Mathematics	none	1 or 2	first or second

Vrsta predmeta / Course type	izbirni / elective
Univerzitetna koda predmeta / University course code:	M2214

Predavanja **Lectures**	**Seminar** **Seminar**	**Vaje** **Tutorial**	**Klinične vaje** **work**	**Druge oblike** **študija**	**Samost. delo** **Individ. work**	**ECTS**
45		**30**			**105**	**6**

Nosilec predmeta / Lecturer:	prof. dr. Sandi Klavžar, prof. dr. Matjaž Konvalinka, prof. dr. Marko Petkovšek

Jeziki / Languages:	**Predavanja / Lectures:**	slovenski / Slovene, angleški / English
	Vaje / Tutorial:	slovenski / Slovene, angleški / English

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	**Prerequisites:**
Vpis v letnik študija.	Enrolment in the programme.
Vsebina:	**Content (Syllabus outline):**

Dvanajstera pot (binomski koeficienti, Stirlingova števila 1. in 2. vrste, Lahova števila, razčlenitve ..., z rodovnimi funkcijami) Običajne in eksponentne rodovne funkcije: kombinatorični pomen operacij vsote, produkta, odvoda, kompozicije (eksponentna formula) Formalne potenčne in Laurentove vrste, Lagrangeeva inverzija Druge uporabe rodovnih funkcij (računanje povprečij in varianc, asimptotika koeficientov ...) Pólyeva teorija Načelo vključitev in izključitev, incidenčna algebra, Möbiusova funkcija, Möbiusova inverzija Reducirane algebre, Dirichletova rodovna funkcija Predavatelj izbere še eno izmed naslednjih tem: politopi, incidenčne strukture, simetrične funkcije, diskretna geometrija, upodobitve simetrične grupe	Twelvefold way (binomial coefficients, Stirling numbers of the first and second kind, Lah numbers, partitions etc., using generating functions) Ordinary and exponential generating functions: combinatorial meaning of sum, product, derivative, composition (exponential formula) Formal power series, formal Laurent series, Lagrange inversion Other applications of generating functions (computing the mean and variance, asymptotics of coefficients, etc.) Pólya theory Principle of inclusion and exclusion, incidence algebra, Möbius function, Möbius inversion Reduced algebras, Dirichlet generating function Instructor chooses an additional topic from the following list: polytopes, incidence structures, symmetric functions, discrete geometry, representations of the symmetric group

Temeljni literatura in viri / Readings:

Richard P. Stanley: Enumerative Combinatorics, Vol. 1, Cambridge University Press, New York-Cambridge, 2011.

Richard P. Stanley: Enumerative Combinatorics, Vol. 2, Cambridge University Press, New York-Cambridge, 1999.

Francois Bergeron, Gilbert Labelle, Pierre Leroux: Combinatorial Species and Tree-like Structures, Cambridge University Press, Cambridge-New York-Melbourne, 1998.

Jack H. van Lint, Robin J. Wilson: A Course in Combinatorics, Cambridge University Press, Cambridge, 2001.

Cilji in kompetence:	**Objectives and competences:**

Študent spozna glavne tehnike kombinatornega preštevanja.	The student learns the main techniques of enumerative combinatorics.

Predvideni študijski rezultati:	**Intended learning outcomes:**
Znanje in razumevanje: Študentje poznajo in razumejo vlogo rodovnih funkcij in algebrskih struktur pri študiranju kombinatornih problemov. Uporaba: Študentje znajo uporabljati teorijo rodovnih funkcij in algebrskih struktur za reševanje kombinatornih problemov.Refleksija: Študentje spoznajo povezavo med strukturo kombinatornega problema in algebraično naravo pripadajočih rodovnih funkcij oziroma drugih struktur.Prenosljive spretnosti – niso vezane le na en predmet: Uporaba rodovnih funkcij v verjetnosti, poglobljeno razumevanje klasične Möbiusove funkcije, delovanje grup na množici.	Knowledge and understanding: Students understand the role of generating functions and algebraic structures in the study of combinatorial problems.Application: Students know how to use generating functions and algebraic structures to solve combinatorial problems.Reflection: The students learn the connection between the structure of the combinatorial problem and the algebraic nature of the corresponding generating functions and other structuresTransferable skills: Applications of generating functions in probability, a deeper understanding of the classical Möbius function, action of a group on a set.

Metode poučevanja in učenja:	**Learning and teaching methods:**
predavanja, vaje, domače naloge, konzultacije	lectures, exercises, homeworks, consultations

Načini ocenjevanja:	Delež (v %) / Weight (in %)	**Assessment:**
Način (pisni izpit, ustno izpraševanje, naloge, projekt):		Type (examination, oral, coursework, project):
izpit iz vaj (2 kolokvija ali pisni izpit)	50%	2 midterm exams instead of written exam, written exam
ustni izpitOcene: 1-5 (negativno), 6-10 (pozitivno) (po Statutu UL)	50%	oral examGrading: 1-5 (fail), 6-10 (pass) (according to the Statute of UL)

Reference nosilca / Lecturer's references:

Sandi Klavžar:

ILIĆ, Aleksandar, KLAVŽAR, Sandi, RHO, Yoomi. The index of a binary word. Theoretical computer science, ISSN 0304-3975, 2012, vol. 452, str. 100-106. [COBISS.SI-ID 16340057]

KLAVŽAR, Sandi, SHPECTOROV, Sergey. Asymptotic number of isometric generalized Fibonacci cubes. European journal of combinatorics, ISSN 0195-6698, 2012, vol. 33, no. 2, str. 220-226. [COBISS.SI-ID 16055641]

FRONČEK, Dalibor, JEREBIC, Janja, KLAVŽAR, Sandi, KOVÁŘ, Petr. Strong isometric dimension, biclique coverings, and Sperner's theorem. Combinatorics, probability & computing, ISSN 0963-5483, 2007, vol. 16, iss. 2, str. 271-275. [COBISS.SI-ID 14286425]

Matjaž Konvalinka:

KONVALINKA, Matjaž, PAK, Igor. Triangulations of Cayley and Tutte polytopes. Advances in mathematics, ISSN 0001-8708, 2013, vol. 245, str. 1-33. [COBISS.SI-ID 16706905]

KONVALINKA, Matjaž. Skew quantum Murnaghan-Nakayama rule. Journal of algebraic combinatorics, ISSN 0925-9899, 2012, vol. 35, no. 4, str. 519-545. [COBISS.SI-ID 16250713]

KONVALINKA, Matjaž. Divisibility of generalized Catalan numbers. Journal of combinatorial theory. Series A, ISSN 0097-3165, 2007, vol. 114, iss. 6, str. 1089-1100. [COBISS.SI-ID 14354265]

Marko Petkovšek:

PETKOVŠEK, Marko. Counting Young tableaux when rows are cosets. Ars combinatoria, ISSN 0381-7032, 1994, let. 37, str. 87-95. [COBISS.SI-ID 8048473]

PETKOVŠEK, Marko, WILF, Herbert S., ZEILBERGER, Doron. A=B. Wellesley (Massachusetts): A. K. Peters, cop. 1996. VII, 212 str. ISBN 1-56881-063-6. [COBISS.SI-ID 4085337]

PETKOVŠEK, Marko. Letter graphs and well-quasi-order by induced subgraphs. Discrete Mathematics, ISSN 0012-365X. [Print ed.], 2002, vol. 244, no. 1-3, str. 375-388. [COBISS.SI-ID 11414873]