

UČNI NAČRT PREDMETA / COURSE SYLLABUS							
<b>Predmet:</b>		Konveksnost					
<b>Course title:</b>		Convexity					
<b>Študijski program in stopnja</b> Study programme and level		<b>Študijska smer</b> Study field		<b>Letnik</b> Academic year		<b>Semester</b> Semester	
Magistrski študijski program Matematika		ni smeri		1 ali 2		prvi ali drugi	
Master's study programme Mathematics		none		1 or 2		first or second	
<b>Vrsta predmeta / Course type</b>				izbirni			
<b>Univerzitetna koda predmeta / University course code:</b>				M2312			
<b>Predavanja</b> Lectures	<b>Seminar</b> Seminar	<b>Vaje</b> Tutorial	<b>Klinične vaje</b> work	<b>Druge oblike študija</b>	<b>Samost. delo</b> Individ. work	<b>ECTS</b>	
45		30			105	6	
<b>Nosilec predmeta / Lecturer:</b>				doc. Klemen Šivic, prof. Franc Forstnerič			
<b>Jeziki / Languages:</b>		<b>Predavanja / Lectures:</b> slovenski/Slovene, angleški/English					
		<b>Vaje / Tutorial:</b> slovenski/Slovene, angleški/English					
<b>Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:</b>				<b>Prerequisites:</b>			
<b>Vsebina:</b>				<b>Content (Syllabus outline):</b>			

<p>Afine in konveksne množice. Topološke lastnosti konveksnih množic. Caratheodorijev in Radonov izrek. Separacijski izreki. Ekstremne točke. Politopi. Stožci in polare. Poliedri. Izrek Weyla in Minkowskega. Sistemi linearnih neenačb. Farkaseva lema in linearno programiranje. Posplošitve Hellyjevega izreka. Metrični prostor konveksnih množic. Blaschkejev izrek. Metrične lastnosti konveksnih množic. Konveksne funkcije. Zveznost, odvedljivost in subgradient. Ekstrema.</p>	<p>Affine and convex sets. Topological properties of convex sets. Theorems of Caratheodory and Radon. Separation theorems. Extreme points. Polytopes. Cones and polars. Polyhedra. The theorem of Weyl and Minkowski. Systems of linear inequations. The Farkas lemma and linear programming. Generalizations of the theorem of Helly. The metric space of convex sets. The Blaschke theorem. Metric properties of convex sets. Convex functions. Continuity, differentiability and the subgradient. Extrema.</p>
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**Temeljni literatura in viri / Readings:**

H. G. EGGLESTON: Convexity, Cambridge Univ. Press, Cambridge, 1958.  
A. BRØNDSTED: An Introduction to Convex Polytopes, Springer, New York-Berlin, 1983.  
F. A. VALENTINE: Convex Sets, Robert E. Krieger, Huntington, 1976.  
R. T. ROCKAFELLAR: Convex Analysis, Princeton Univ. Press, Princeton, 1996.  
A. W. ROBERTS, D. E. VARBERG: Convex Functions, Academic Press, New York-London, 1973.

**Cilji in kompetence:**

Študent spozna osnovne pojme konveksne geometrije in konveksne analize. Seznan je z lastnostmi konveksnih množic in konveksnih funkcij v evklidskih in normiranih prostorih ter z uporabo teorije na raznih področjih matematike. Pri tem povezuje geometrijsko intuicijo z algebro, analizo in kombinatoriko.

**Objectives and competences:**

The student learns the basic concepts of convex geometry and convex analysis. The student gets familiar with the properties of convex sets and convex functions in euclidean and normed spaces and applications of the theory in different areas of mathematics. The student combines geometric intuition with algebra, analysis and combinatorics.

**Predvideni študijski rezultati:**

Znanje in razumevanje: Poznavanje in razumevanje osnovnih pojmov teorije konveksnih množic in konveksnih funkcij. Sinteza metod iz linearne algebre, analize in geometrije.

Uporaba:

Uporaba teorije pri reševanju problemov na

**Intended learning outcomes:**

Knowledge and understanding: Knowledge and understanding of basic concepts of the theory of convex sets and convex functions. A synthesis of methods of linear algebra, analysis and geometry.

Application:

Solving problems in different areas of

raznih področjih matematike in drugih znanosti.

Refleksija:

Razumevanje teorije na podlagi primerov in uporabe.

Prenosljive spretnosti – niso vezane le na en predmet:

Postavitev problema, njegova matematična formulacija ter reševanje in analiza. Prenos teorije v prakso.

mathematics and other sciences using the theory.

Reflection:

Understanding the theory on the basis of examples and applications.

Transferable skills:

Posing of a problem, its mathematical formulation, solving and analysis. The transfer of the theory into praxis.

**Metode poučevanja in učenja:**

predavanja, vaje, domače naloge, konzultacije

**Learning and teaching methods:**

Lectures, exercises, homeworks, consultations

Delež (v %) /  
Weight (in %)

**Načini ocenjevanja:**

**Assessment:**

<p>Način (pisni izpit, ustno izpraševanje, naloge, projekt): izpit iz vaj (2 kolokvija ali pisni izpit)</p> <p>ustni izpit</p> <p>Ocene: 1-5 (negativno), 6-10 (pozitivno) (po Statutu UL)</p>	<p>50%</p> <p>50%</p>	<p>Type (examination, oral, coursework, project): 2 midterm exams instead of written exam, written exam</p> <p>oral exam</p> <p>Grading: 1-5 (fail), 6-10 (pass) (according to the Statute of UL)</p>
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**Reference nosilca / Lecturer's references:**

Franc Forstnerič:  
– FORSTNERIČ, Franc. Embedding strictly pseudoconvex domains into balls. Transactions of the

American Mathematical Society, ISSN 0002-9947, 1986, let. 295, št. 1, str. 347-368 [COBISS.SI-ID 8206425]

– FORSTNERIČ, Franc. Noncritical holomorphic functions on Stein manifolds. *Acta mathematica*, ISSN 0001-5962, 2003, vol. 191, no. 2, str. 143-189 [COBISS.SI-ID 13138009]

– FORSTNERIČ, Franc. Runge approximation on convex sets implies the Oka property. *Annals of mathematics*, ISSN 0003-486X, 2006, vol. 163, no. 2, str. 689-707 [COBISS.SI-ID 13908825]

Klemen Šivic:

– KUZMA, Bojan, OMLADIČ, Matjaž, ŠIVIC, Klemen, TEICHMANN, Josef. Exotic one-parameter semigroups of endomorphisms of a symmetric cone. *Linear Algebra and its Applications*. [Print ed.]. 2015, vol. 477, str. 42-75. ISSN 0024-3795. [COBISS.SI-ID 17257561] [COBISS.SI-ID 17257561]

– KANDIČ, Marko, ŠIVIC, Klemen. On the dimension of the algebra generated by two positive semi-commuting matrices. *Linear Algebra and its Applications*. [Print ed.]. 2017, vol. 512, str. 136-161. ISSN 0024-3795. [COBISS.SI-ID 17776985] [COBISS.SI-ID 17776985]

– KLEP, Igor, MCCULLOUGH, Scott, ŠIVIC, Klemen, ZALAR, Aljaž. There are many more positive maps than completely positive maps. *International mathematics research notices*. June 2019, vol. 2019, iss. 11, str. 3313-3375. ISSN 1073-7928. [COBISS.SI-ID 18670425] [COBISS.SI-ID 18670425]