UČNI NAČRT PREDMETA / COURSE SYLLABUS	
Predmet:	**Fraktali in dinamični sistemi**
Course title:	**Fractals and dynamical systems**

Študijski program in stopnja Study programme and level	Študijska smer Study field	Letnik Academic year	Semester Semester
Matematika, 2. stopnja		**1. ali 2.**	**1. ali 3.**
Mathematics, 2nd degree		**1. or 2.**	**1. or 3.**

Vrsta predmeta / Course type	izbirni / elective

Univerzitetna koda predmeta / University course code:

Predavanja Lectures	Seminar Seminar	Sem. vaje Tutorial	Lab. vaje Laboratory work	Teren. vaje Field work	Samost. delo Individ. work		ECTS
45		**15**	**15**		**135**		**7**

Nosilec predmeta / Lecturer:	Mateja Grašič

Jeziki / Languages:	Predavanja / Lectures:	SLOVENSKO/SLOVENE
	Vaje / Tutorial:	SLOVENSKO/SLOVENE

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	Prerequisits:
Linearna algebra, Algebra, Analiza 2	Linear algebra, Algebra, Analysis 2

Vsebina:

- Metrični prostor, različne vrste podprostorov, prostor fraktalov.
- Afine transformacije, skrčitve, sistemi iterirajočih funkcij.
- Osnove dinamičnih sistemov, dinamika fraktalnih množic.
- Teoretično in eksperimentalno določanje dimenzije fraktala, Hausdorff-Bezikovičeva dimenzija.
- Juliajeve množice, primeri njihove uporabe.

Content (Syllabus outline):

- A metric space, different types of subspaces, the space of fractals.
- Affine transformations, contraction mappings, systems of iterating functions.
- Introduction to dynamical systems, dynamics on fractal sets.
- The theoretical and experimental determination of the fractal dimension, Hausdorff-Besicovitch dimension.
- Julia sets, examples of their application.

Temeljni literatura in viri / Readings:

G. Edgar: Classics on Fractals. Westview Press, Boulder (1992).

K. J. Falconer: Fractal Geometry. J. Wiley, Chichester (1990).

Y. Pesin, V. Climenhaga: Lectures on Fractal Geometry and Dynamical Systems, American Mathematical Society (2009).

R. Devaney: An Introduction To Chaotic Dynamical Systems, 2nd ed., Westview Press (2003).

J. Vrabec: Metricni prostori. Ljubljana: DMFA (1993).

Cilji in kompetence:	Objectives and competences:
Študenti se seznanijo s strukturo podprostora fraktalov v metričnem prostoru in z osnovnimi načini generiranja fraktalov (družine iterirajočih preslikav). Spoznajo tudi različne pristope k določanju dimenzije fraktala ter dinamiko fraktalnih množic.	Students get familiar with the structure of the subset of fractals in a metric space and with the main ways of generating fractals (iterated functions systems). They also study different approaches to the fractal dimension and the dynamics of fractal sets.

Predvideni študijski rezultati:	Intended learning outcomes:
Znanje in razumevanje: - aktivno obvladanje strukture metričnega prostora in prepoznavanje fraktalnih podmnožic - teoretično in eksperimentalno določanje dimenzije fraktalov - analiza dinamičnih sistemov in njihova uporaba Prenesljive/ključne spretnosti in drugi atributi: - sposobnost generiranja fraktalov - izračun dimenzije fraktalne množice - modeliranje z dinamičnimi sistemi	Knowledge and Understanding: - active knowledge of metric space structure and the ability to recognize its fractal subsets - theoretical and experimental ways for finding the dimension of a fractal - the analysis of dynamical systems and their application Transferable/Key Skills and other attributes: - the abbility to generate fractals - the calculation of fractal dimension - modeling with dynamical systems

Metode poučevanja in učenja:	Learning and teaching methods:
• Predavanja • Seminarske, laboratorijske vaje • Individualno delo	• Lectures • Tutorial • Individual work

Načini ocenjevanja: / **Assessment:**

Način (pisni izpit, ustno izpraševanje, naloge, projekt):	Delež (v %) / Weight (in %)	Type (examination, oral, coursework, project):
Seminarska naloga	20%	Seminar work
Pisni izpit– praktični del	40%	Written exam – practical part
Ustni izpit – teoretični del	40%	Oral exam – theoretical part
Pisni izpit – praktični del se lahko nadomesti z dvema delnima testoma (sprotni obveznosti).		Written exam – practical part can be replaced by two partial tests (mid-term testing).
Vsaka izmed naštetih obveznosti mora		Each of the mentioned commitments

biti opravljena s pozitivno oceno. Opravljen pisni del izpita je pogoj za pristop k teoretičnem delu izpita.	must be assessed with a passing grade. Passing grade of the written exam is required for taking the oral exam.

Reference nosilca / Lecturer's references:

1. BENKOVIČ, Dominik, GRAŠIČ, Mateja. Jordan {*g,h*}-derivations of unital algebras. *Operators and matrices*. 2022, vol. 16, no. 2, str. 415-428. ISSN 1846-3886. http://oam.ele-math.com/16-32/Jordan-g,h-derivations-of-unital-algebras, DOI: 10.7153/oam-2022-16-32. [COBISS.SI-ID 114972163]

2. XIA, Yong-Hui, GRAŠIČ, Mateja, HUANG, Wentao, ROMANOVSKI, Valery. Limit cycles in a model of olfactory sensory neurons. *International journal of bifurcation and chaos in applied sciences and engineering*. 2019, vol. 29, no. 3, str. 1950038-1-1950038-9. ISSN 0218-1274. DOI: 10.1142/S021812741950038X. [COBISS.SI-ID 22250006]

3. BENKOVIČ, Dominik, GRAŠIČ, Mateja. Generalized skew derivations on triangular algebras determined by action on zero products. *Communications in algebra*. 2018, vol. 46, iss. 5, str. 1859-1867. ISSN 0092-7872. https://doi.org/10.1080/00927872.2017.1360334, DOI: 10.1080/00927872.2017.1360334. [COBISS.SI-ID 18505817]