UČNI NAČRT PREDMETA / COURSE SYLLABUS

Predmet:	**Izbrana poglavja iz diferencialnih enačb**
Course title:	**Selected Chapters from Differential Equations**

Študijski program in stopnja Study programme and level	Študijska smer Study field	Letnik Academic year	Semester Semester
Matematika, 3. stopnja		**1. ali 2.**	**1. ali 3. ali 4.**
Mathematics, 3rd cycle		**1st or 2nd**	**1st or 3rd or 4th**

Vrsta predmeta / Course type izbirni/elective

Univerzitetna koda predmeta / University course code:

Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Klinične vaje work	Druge oblike študija	Samost. delo Individ. work	ECTS
30					**150**	**6**

Nosilec predmeta / Lecturer: Valerij Romanovskij

Jeziki / Languages:	Predavanja / Lectures:	Slovenski / Slovene
	Vaje / Tutorial:	

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	**Prerequisits:**
Znanje osnovnih pojmov in rezultatov iz teorije NDE	Basic knowledge of fundamental notions and results of the theory of ODE's

Vsebina:

Izbrana so posebna poglavja iz teorije dinamičnih sistemov, funkcij Ljapunova, normalnih form, Poincarejevega problema centra, invariant diferencialnih enačb, izohronosti nihanj, bifurkacij limitnih ciklov ali katerega drugega modernega področja teoriji dinamičnih sistemov. Izbira poglavij je odvisna od interesa in raziskovalne usmerjenosti študentov. Spodaj navedena literatura praviloma služi le kot osnova in je nadgrajena z bolj specializiranimi teksti.

Content (Syllabus outline):

Special topics in dynamical systems, Lyapunov functions, normal forms, Poincare center problem, invariants of differential equations, isochronicity of oscillations, limit cycles bifurcations or some other area of contemporary theory of dynamical systems are chosen. The choice depends on students' interests and their research orientation. The literature below in principle serves only as a basis, and is combined with more specialized texts.

Temeljni literatura in viri / Readings:

- D. K. Arowsmith, C. M. Place, Dynamical systems: diferential equations, maps an chaotic behaviour, Chapman & Hall/CRC, Boca Raton, 1998
- S. Lynch, Dynamical Systems with Applications using Mathematica, Springer Science & Business Media, 2007.

Dodatna literatura / Additional Readings:

- X. Zhang, Integrability of Dynamical Systems: Algebra and Analysis. Springer, 2017.
- J. Guckenheimer, P. Holmes, Nonlinear oscillations, dynamical systems and bifurcations of vector fields, Applied Mathematical sciences, 42, Springer-Verlag, New York 1983.
- J. A. Murdock, Normal forms and unfoldings for local dynamical systems, Springer, New York, 2003
- V. G. Romanovski, D.S. Shafer, The Center and Cyclicity Problems A Computational Algebra Approach. Birkhäuser, Boston, 2009

Cilji in kompetence:

- Razumevanje osnovnih načinov kvalitativne in bifurkacijske analize diferencialnih enačb
- Poznavanje metod študija lastnosti rešitev diferencialnih enačb in gladkih preslikav
- Pridobiti si sposobnost detaljne analize določenih matematičnih modelov opisanih z navadnimi diferencialnimi enačbami ali gladkimi preslikavami
- Zmožnost razvijanja kritične refleksije na področju diferencialnih enačb

Objectives and competences:

- Understanding main approaches to the qualitative and bifurcational analysis of differential equations
- Gaining knowledege of methods of studying the properties of solutions of differential equations and smooth maps
- Gaining skills of detail analysis of certain mathematical model described by ordinary differential equations or smoth maps
- Ability to develop critical reflection in differential equations

Predvideni študijski rezultati:

Znanje in razumevanje:

- Razumevanje metod kvalitativne in bifurkacijske analize dinamičnih sistemov
- Pridobivanje sposobnosti sistematskega študija rešitev dinamičnih sistemov in njihovih lastnosti

Intended learning outcomes:

Knowledge and understanding:

- Understanding of methods of qualitative and bifurcational analysis of dynamical systems
- Gaining some systematic approaches to studying of solutions of dynamical systems and their properties

Prenesljive/ključne spretnosti in drugi atributi:	Transferable/Key Skills and other attributes:
• podlaga za raziskovalno delo na področju dinamičnih sistemov	• a basis for research in the theory of dynamical systems

Metode poučevanja in učenja:

- predavanja;
- priprava seminarja;
- konzultacije;
- samostojni študij.

Learning and teaching methods:

- lectures;
- seminar work;
- consultations;
- self-study.

Načini ocenjevanja:	Delež (v %) / Weight (in %)	Assessment:
Seminarska naloga	50 %	Seminar paper
Teoretični izpit	50 %	Theoretical exam

Reference nosilca / Lecturer's references:

1. ARCET, Barbara, ROMANOVSKI, Valery. Integrability and linearizability of symmetric three-dimensional quadratic systems. *Discrete and continuous dynamical systems. Series S*. April 2022, 18 str. ISSN 1937-1632. DOI: 10.3934/dcdss.2022104. [COBISS.SI-ID 130109955], [JCR, SNIP, WoS, Scopus]
kategorija: 1A2

2. MASTEV, Ivan, ROMANOVSKI, Valery, TIAN, Yun. Rational involutions and an application to planar systems of ODE. *Mathematics*. 2024, vol. 12, no. 3, [article no.] 486, 16 str. ISSN 2227-7390. https://dk.um.si/IzpisGradiva.php?id=89790, DOI: 10.3390/math12030486. [COBISS.SI-ID 184531971], [JCR, SNIP, WoS, Scopus]
kategorija: 1A1

3. DREXLER, Dániel András, NAGY, Ilona, ROMANOVSKI, Valery. Stability analysis of the singular points and Hopf bifurcations of a tumor growth control model. *Mathematical methods in the applied sciences*. 15 May 2024, vol. 47, iss. 7, str. 5677-5691. ISSN 1099-1476. https://dk.um.si/IzpisGradiva.php?id=89788, Digitalna knjižnica Univerze v Mariboru – DKUM, DOI: 10.1002/mma.9885. [COBISS.SI-ID 184526595], [JCR]
kategorija: 1A1

4. GINÉ, Jaume, ROMANOVSKI, Valery, TORREGROSA, Joan. Time-reversibility and integrability of p : -q resonant vector fields. *AIMS mathematics*. 2024, vol. 9, iss. 1, str. 73-88. ISSN 2473-6988. DOI: 10.3934/math.2024005. [COBISS.SI-ID 184528899], [JCR]
kategorija: 1A1

5. ARCET, Barbara, GINÉ, Jaume, ROMANOVSKI, Valery. Linearizability of planar polynomial Hamiltonian systems. *Nonlinear analysis: real world applications*. Feb. 2022, vol. 63, 19 str. ISSN 1468-1218. DOI: 10.1016/j.nonrwa.2021.103422. [COBISS.SI-ID 110154755], [JCR] kategorija: 1A1