Univerza v Mariboru

Fakulteta za naravoslovje in matematiko

UČNI NAČRT PREDMETA / COURSE SYLLABUS	
Predmet:	**Kompleksna analiza**
Course title:	**Complex Analysis**

Študijski program in stopnja Study programme and level	Študijska smer Study field	Letnik Academic year	Semester Semester
Izobraževalna matematika – enopredmetna, 2. Stopnja	**Modul I2**	**1. ali 2.**	**1. ali 3.**
Educational mathematics - single-major, 2nd cycle	**Module I2**	**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		**30**			**105**	**6**

Nosilec predmeta / Lecturer: Marko JAKOVAC

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

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	**Prerequisits:**
Poznavanje analize in kompleksnih števil.	Knowledge of analysis and complex numbers.

Vsebina: **Content (Syllabus outline):**

Funkcije kompleksne spremenljivke. Elementarne funkcije v kompleksnem: linearne funkcije, ulomljene linearne funkcije. Potenčne vrste v kompleksnem. Elementarne funkcije, definirane s potenčnimi vrstami. Logaritem in ciklometrične funkcije. Holomorfne funkcije. Cauchy – Riemannov izrek. Konformnost holomorfnih funkcij. Integral funkcije kompleksne spremenljivke. Cauchyjev izrek in Cauchyjeve formule. Liouvilleov izrek. Taylorjeva vrsta. Laurentova vrsta. Klasifikacija izoliranih singularnih točk. Obnašanje holomorfnih funkcij v okolici izoliranih singularnih točk. Casorati–Weierstrassov izrek. Mali in veliki Piccardov izrek. Izrek o residuumih. Uporaba pri računanju realnih integralov.	Functions of complex variable. Elementary functions: linear function, Möbius functions. Power series. Elementary functions defined by power series. Logarithm and cyclometric functions. Holomorphic functions. Cauchy – Riemann theorem. Conformality of holomorphic mappings. Complex line integrals. Cauchy's integral theorem and Cauchy's formulae. Liouville's theorem. Power series representation. Laurent series. Classification of isolated singularities. The behaviour of holomorphic functions near isolated singularities. Casorati–Weierstrass theorem. Piccard's little and great theorem. Residui theorem. Applications to the calculations of definite real integrals and sums.

Temeljni literatura in viri / Readings:

- L. Ahlfors: *Complex Analysis,* 3rd edition, McGraw-Hill, New york, 1979.
- R.B. Ash, W.P. Novinger: *Complex Variables*, 2nd edition, Dover Publications, New York, 2007.
- J.B. Conway: *Functions of One Complex Variable I,* 2nd edition, Springer, New York, 1995.
- S. G. Krantz: *Handbook of Complex Variables,* Birkhäuser, Boston, 1999.
- W. Rudin, *Real and Complex Analysis*, 3rd edition, McGraw-Hill Education, New York, 1986.

Cilji in kompetence:	**Objectives and competences:**
Študent poglobi znanje iz osnov teorije funkcij kompleksne spremenljivke ter poglobi znanje iz uporabnih aspektov te teorije, predvsem v povezavi s preslikovanji območij, pri računanju določenih integralov in seštevanju vrst.	Deepening the knowledge of concepts from the theory of functions of one complex variable. To deepen the knowledge of possible applications of this theory, specialy in connection with transformations of the regions, calculating definite integrals and sums.

Predvideni študijski rezultati:	**Intended learning outcomes:**
Znanje in razumevanje: • Študent razume pojem holomorfne funkcije pozna osnovne s tem povezane rezultate, posebej tiste, ki se nanašajo na integracijo in na integralsko reprezentacijo ter reprezentacijo s potenčno vrsto. • Študent razume koncept preslikovanja območij z uporabo ulomljenih linearnih in	Knowledge and Understanding: • To understand the concept of holomorphic function and to know the basic results, especialy those about line integrals and about the integral and the power series representation of holomorphic functions. • To understend the concept of transforming plane regions using Möbius transformations

drugih preprostejših elementarnih funkcij v kompleksnem. • Študent razume pojem izolirane singularne točke in pozna uporabno vrednost izreka o residuumih. Prenesljive/ključne spretnosti in drugi atributi: • Ilustracija dejstva, da nam teorija, na videz oddaljena od realnosti, lahko ponudi mnoge praktično uporabne rezultate.	and other basic elementary functions. • To understand the concept of an isolated singularity and to be aware of the importance of the residui theorem. Transferable/Key Skills and other attributes: • An illustration of the fact, that a more abstract theory can give us many nice results with useful practical applications.
Metode poučevanja in učenja:	**Learning and teaching methods:**
• Predavanja • Seminarske vaje	• Lectures • Tutorial
Načini ocenjevanja:	**Assessment:**

	Delež (v %) / Weight (in %)	
Izpit:		Exams:
Pisni izpit – problemi	50%	Written exam – problems
Ustni izpit – teorija	50%	Oral exam – theory
Vsaka izmed naštetih obveznosti mora biti opravljena s pozitivno oceno.		Each of the mentioned assessments must be assessed with a passing grade.
Opravljen pisni izpit – problemi je pogoj za pristop k ustnemu izpitu – teorija.		Passing grade of written exam – problems is required to take the oral exam – theory.
Pisni izpit – problemi se lahko nadomesti z dvema delnima testoma (sprotne obveznosti).		Written exam – problems can be replaced with two mid-term tests.

Reference nosilca / Lecturer's references:

1. JAKOVAC, Marko, MESARIČ ŠTESL, Daša. On game chromatic vertex-critical graphs. *Bulletin of the Malaysian Mathematical Sciences Society*. Jan. 2023, vol. 46, iss. 1, str. 1-30, ilustr. ISSN 0126-6705. https://link.springer.com/article/10.1007/s40840-022-01418-6, DOI: 10.1007/s40840-022-01418-6. [COBISS.SI-ID 139148291]

2. DRAVEC, Tanja, JAKOVAC, Marko, KOS, Tim, MARC, Tilen. On graphs with equal total domination and Grundy total domination numbers. *Aequationes mathematicae*. Feb. 2022, vol. 96, iss. 1, 137-146. ISSN 0001-9054. https://link.springer.com/article/10.1007/s00010-021-00776-z, DOI: 10.1007/s00010-021-00776-z. [COBISS.SI-ID 100359427]

3. BUJTÁS, Csilla, JAKOVAC, Marko, TUZA, Zsolt. The *k*-path vertex cover: general bounds and chordal graphs. *Networks*. July 2022, vol. 80, iss. 1, str. 63-76. ISSN 0028-3045. https://onlinelibrary.wiley.com/doi/10.1002/net.22079, DOI: 10.1002/net.22079. [COBISS.SI-ID 116964355]

4. BREŠAR, Boštjan, JAKOVAC, Marko, MESARIČ ŠTESL, Daša. Indicated coloring game on Cartesian products of graphs. *Discrete applied mathematics*. [Print ed.]. Jan. 2021, vol. 289, str. 320-326. ISSN 0166-218X. https://www.sciencedirect.com/science/article/pii/S0166218X2030500X, DOI: 10.1016/j.dam.2020.11.007. [COBISS.SI-ID 41803267]

5. JAKOVAC, Marko, OTACHI, Yota. On the security number of the Cartesian product of graphs. *Discrete applied mathematics*. [Print ed.]. Dec. 2021, vol. 304, str. 119-128. ISSN 0166-218X. DOI: 10.1016/j.dam.2021.07.030. [COBISS.SI-ID 72524547]