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
Matematika		**3.**	**5.**
Mathematics		**3.**	**5.**

Vrsta predmeta / Course type Obvezni/Compulsory

Univerzitetna koda predmeta / University course code:

Predavanja Lectures	Seminar Seminar	Sem. vaje Tutorial	Lab. vaje Lab. work	Teren. vaje Field work	Samost. delo Indiv. work	ECTS
45	**15**	**30**			**120**	**7**

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 realne analize in kompleksnih števil. Vsaka izmed naštetih obveznosti v načinih ocenjevanja mora biti opravljena s pozitivno oceno. Pozitivna ocena pri pisnem izpitu in opravljena seminarska naloga sta pogoj za pristop k ustnemu izpitu.	Knowledge of real analysis and complex numbers. Each of the listed obligations in the assessments must be completed with a positive grade. Passing grade of the written exam and the completed seminar paper are required for taking the oral exam.

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

Funkcije ene 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 integralske formule. Liouvilleov izrek. Osnovni izrek algebre. Mali Picardov izrek. Taylorjeva vrsta. Upodobitev holomorfnih funkcij s potenčnimi vrstami. Laurentova vrsta. Klasifikacija izoliranih singularnih točk. Obnašanje holomorfnih funkcij v okolici izoliranih singularnih točk. Casorati–Weierstrassov izrek. Veliki Piccardov izrek. Izrek o residuumih. Uporaba pri računanju realnih integralov. Izbrana poglavja iz realne in kompleksne analize.	Functions of one complex variable. Complex elementary functions: linear function, Möbius functions. Complex 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 theorem and Cauchy's integral formulae. Liouville's theorem. Fundamental theorem of algebra. Picard's little theorem. Taylor series. Power series representation of holomorphic functions. Laurent series. Classification of isolated singularities. The behaviour of holomorphic functions near isolated singularities. Casorati–Weierstrass theorem. Piccard's great theorem. Residui theorem. Applications to the calculations of definite real integrals and sums. Selected topics in real and complex analysis.

Temeljni literatura in viri / Readings:

1. Howie, J. M. (2004). *Complex analysis* (2nd printing, str. XI, 260). Springer.
2. Freitag, E., & Busam, R. (2005). *Complex Analysis*. Springer. http://link.springer.com/book/10.1007/3-540-30823-7
3. Bak, J., & Newman, D. J. (1982). *Complex analysis* (str. X, 244). Springer.
4. Rudin, W. (1987). *Real and complex analysis* (3rd ed., str. XIV, 416). McGraw-Hill.

Dodatna literatura / Additional readings:

1. Ahlfors, L. V. (1979). *Complex analysis: an introduction to the theory of analytic functions of one complex variable* (3rd ed., str. XIV, 331). McGraw-Hill.
2. Ash, R. B. (1971). *Complex variables* (str. VIII, 255). Academic press.
3. Conway, J. B. (1973). *Functions of one complex variable* (Let. 11, str. XI, 313). Springer.
4. Krantz, S. G. (2022). *Handbook of complex analysis* (1st ed., str. XI, 534). Chapman & Hall/CRC.

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 pojasni 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 pojasni koncept preslikovanja območij z uporabo ulomljenih linearnih in drugih preprostejših elementarnih funkcij v kompleksnem. • Študent pojasni 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.	Knowledge and understanding: • The student explains 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. • The student explains the concept of transforming plane regions using Möbius transformations and other basic elementary functions. • The student explains 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 • Seminar • Seminarske vaje	• Lectures • Seminar • Tutorial

Načini ocenjevanja:	Delež (v %) / Weight (in %)	**Assessment:**
Seminarska naloga	10 %	Seminar paper
Pisni izpit	50 %	Written exam
Ustni izpit	40 %	Oral exam

Opombe:

Pisni izpit se lahko nadomesti s kolokviji.

Comments:

Written exam can be replaced by midterm examination.

Reference nosilca / Lecturer's references:

1. BREŠAR, Boštjan, FERME, Jasmina, HOLUB, Přemysl, JAKOVAC, Marko, MELICHAROVÁ, Petra. *S-*

packing colorings of distance graphs with distance sets of cardinality 2. Applied mathematics and computation. [Print ed.]. Apr. 2025, vol. 490, [article no.] 129200, 13 str. ISSN 0096-3003. https://www.sciencedirect.com/science/article/pii/S0096300324006611, DOI: 10.1016/j.amc.2024.129200. [COBISS.SI-ID 216160771]

2. 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]

3. 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]

4. 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]