Univerza v Mariboru

Fakulteta za naravoslovje in matematiko

UČNI NAČRT PREDMETA / COURSE SYLLABUS	
Predmet:	**Analiza IV**
Course title:	**Analysis IV**

Študijski program in stopnja Study programme and level	Študijska smer Study field	Letnik Academic year	Semester Semester
Matematika		**2.**	**4.**
Mathematics		**2.**	**4.**

Vrsta predmeta / Course type	Obvezni / Obligatory
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
60		**45**			**135**	**8**

Nosilec predmeta / Lecturer:	Bojan HVALA

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

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	**Prerequisits:**
Vsaka izmed naštetih obveznosti v načinih ocenjevanja mora biti opravljena s pozitivno oceno. Pozitivna ocena pri pisnem izpitu je pogoj za pristop k ustnemu izpitu.	Each of the mentioned commitments must be assessed with a passing grade. Passing grade of the written exam is required for taking the oral exam.
Vsebina:	**Content (Syllabus outline):**
Dvojni in trojni integral. Polarne, cilindrične in sferne koordinate. Uporaba. Posplošeni dvojni integral. Krivulje v ravnini in prostoru. Parametrizacija, tangenta, ločna dolžina, ukrivljenost. Spremljajoči trieder. Ploskve v prostoru. Površina.	Double and triple integrals. Polar, cylindrical and spherical coordinates. Applications. Generalized double integral. Plane and space curves. Parametrization, tangent, arc length, curvature. Surfaces. Area. Scalar and vector fields. Line and surface

Skalarna in vektorska polja. Krivuljni in ploskovni integrali. Gradient, divergenca, rotor. Gaussov in Stokesov izrek. Primeri uporabe.	integrals. Gradient, divergence, curl. Divergence theorem. Stokes' theorem. Applications.

Temeljni literatura in viri / Readings:

- M. H. Protter, C. B. Morrey: *Intermediate calculus.* New York : Springer, 1985.
- M. Dobovišek: *Rešene naloge iz analize II.* Ljubljana: DMFA, 1996.
- B. Hvala: *Zbirka izpitnih nalog iz analize.* Ljubljana: DMFA, 1996.
- S. Lang: *Calculus of several variables,* 3rd ed. Springer-Verlag, 1987.

Dodatna literatura/Additional Readings:

- D. Varberg, E. Purcell, S. Rigdon: *Calculus*. Prentice Hall, 2006.
- D. J. Struik: *Lectures on Classical Differential Geometry.* Cambridge: Mass., Addison-Wesley Press, 1950.

Cilji in kompetence:	**Objectives and competences:**
Spoznati glavna dejstva o krivuljah in ploskvah. Spoznati koncepte integracije po merljivih množicah v ravnini in prostoru ter po krivuljah in ploskvah. Spoznati povezave med obravnavanimi integrali. Seznaniti se z možnostmi uporabe te teorije v fiziki in drugje.	Knowing basic facts about curves and surfaces. Knowing concepts of integration on measurable subsets of plane and space and on curves and surfaces. Knowing basic relations between those integrals. Being familiar with the applications of this theory.

Predvideni študijski rezultati:	**Intended learning outcomes:**
Znanje in razumevanje: Po zaključku tega predmeta bo študent • Razumel koncept dvojnega in trojnega integrala, znal te integrale računati in jih uporabljati v standardnih situacijah. • Poznal osnove diferencialne geometrije krivulj in ploskev v prostoru. Poznal bo definicije dolžine loka, ukrivljenosti krivulje, površine ploskve in jih znal računati. • Znal definirati integrale skalarnih in vektorskih funkcij po krivuljah in ploskvah, poznal praktično ozadje teh definicij in jih znal računati. Poznal bo rezultate, ki te	Knowledge and Understanding: On completion of this course a student will be able to • Understand the concept of double and triple integrals, be able to calculate these integrals and use them in standard situations. • Recall the basics of the differential geometry of the curves and surfaces in the space. He will be able to recall the definitions of the length of the arc, the curvature of the curve and the area of a

integrale povezujejo in jih znal uporabiti. Prenesljive/ključne spretnosti in drugi atributi: • *Reševanje problemov:* Širjenje zavesti o moči matematike pri opisovanju sveta. Uporaba obravnavanih tematik v geografiji, astronomiji, fiziki. • *Tehnične spretnosti:* Uporaba računalnika pri predstavitvi ploskev in krivulj ter pri razumevanju ozadja Jacobijeve determinante.	surface. He will be able to compute them. • Define curve and surface integrals of scalar and vector fields, understand the practical background of these definitions and be able to compute them. He will be able to recall the results that connect these integrals and apply them. Transferable/Key Skills and other attributes: • *Problem solving*: Spreading awareness of the power of mathematics in describing the world. Use of discussed topics in geography, astronomy, physics. • *Technical skills*: Using the computer in presenting surfaces and curves, and in explaining the background of Jacobi's determinant.
Metode poučevanja in učenja:	**Learning and teaching methods:**
• Predavanja • Teoretične vaje	• Lectures • Theoretical exercises
Načini ocenjevanja:	**Assessment:**

Pisni izpit Ustni izpit	Delež (v %) / Weight (in %) 50% 50%	Written exam Oral exam

Opombe:
Pisni izpit se lahko nadomesti s kolokviji v enakem deležu 50%.

Comments:
Written exam can be replaced by written midterm examination in the weight of 50%.

Reference nosilca / Lecturer's references:

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1. HVALA, Bojan. Geometrija trikotnika, Oroslan in Ravello. *Obzornik za matematiko in fiziko*. 2021, letn. 68, št. 3, str. 81-99, ilustr. ISSN 0473-7466. [COBISS.SI-ID 88536579]
2. HVALA, Bojan. Cevian cousins of a triangle centroid. *Journal for geometry and graphics*, ISSN 1433-8157, 2015, vol. 19, no. 2, str. 211-218. [COBISS.SI-ID 22024200]
3. HVALA, Bojan. A generalized Seebach's theorem. *Beiträge zur Algebra und Geometrie*, ISSN 0138-4821, 2014, vol. 55, iss. 2, str. 471-478, doi: 10.1007/s13366-013-0165-3. [COBISS.SI-ID 20843272]
4. HVALA, Bojan. Značilne točke trikotnika kot funkcije. Obzornik za matematiko in fiziko, ISSN 0473-7466, 2014, letn. 61, št. 1, str. 1-14. [COBISS.SI-ID 16937817].
5. HVALA, Bojan. Diophantine Steiner triples and Pythagorean-type triangles. *Forum geometricorum*, ISSN 1534-1178, 2010, vol. 10, str. 93-97. http://forumgeom.fau.edu/FG2010volume10/FG201010.pdf. [COBISS.SI-ID 15669337]