



Univerza v Mariboru

Fakulteta za naravoslovje  
in matematiko

### UČNI NAČRT PREDMETA / COURSE SYLLABUS

|                      |                  |
|----------------------|------------------|
| <b>Predmet:</b>      | <b>Analiza I</b> |
| <b>Course title:</b> | Analysis I       |

| Študijski program in stopnja<br>Study programme and level | Študijska smer<br>Study field | Letnik<br>Academic year | Semester<br>Semester |
|-----------------------------------------------------------|-------------------------------|-------------------------|----------------------|
| Matematika, 1. stopnja                                    |                               | 1.                      | 1.                   |
| Mathematics, 1 <sup>st</sup> cycle                        |                               | 1.                      | 1.                   |

**Vrsta predmeta / Course type**

obvezni/compulsory

**Univerzitetna koda predmeta / University course code:**

| Predavanja<br>Lectures | Seminar<br>Seminar | Sem. vaje<br>Tutorial | Lab. vaje<br>Laboratory work | Teren. vaje<br>Field work | Samost. delo<br>Individ. work | ECTS |
|------------------------|--------------------|-----------------------|------------------------------|---------------------------|-------------------------------|------|
| 75                     |                    | 60                    |                              |                           | 165                           | 10   |

**Nosilec predmeta / Lecturer:**

Boštjan Brešar

**Jeziki /**

**Languages:**

**Predavanja /**

**Lectures:**

SLOVENSKO/SLOVENIAN

**Vaje / Tutorial:**

SLOVENSKO/SLOVENIAN

**Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:**

Vsaka izmed naštetih obveznosti v načinih ocenjevanja mora biti opravljena s pozitivno oceno.

Pozitivna ocena pri pisnem izpitu je pogoj pristop k ustnemu izpitu.

**Prerequisites:**

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:**

Osnovni matematični pojmi.  
Realna števila: aksiomi, supremum, maksimum; potence, koreni; iracionalna števila; intervali; absolutna vrednost.  
Kompleksna števila: osnovne lastnosti; polarni zapis.  
Zaporedja: konvergenca, operacije z zaporedji; monotona zaporedja, število  $e$ ; podzaporedja,

**Content (Syllabus outline):**

Basic mathematical concepts.  
Real numbers: axioms, supremum, maximum; powers, roots; irrational numbers; intervals; absolute value.  
Complex numbers: basic properties; trigonometric form.  
Sequences: convergence, operations on sequences; monotone sequences, the number

stekališča; Cauchyjeva zaporedja; potence z realnimi eksponenti.

Vrste: konvergenca; geometrijska vrsta; vrste s pozitivnimi členi, kriteriji za konvergenco; alternirajoče vrste; absolutna in pogojna konvergenca; vsota in produkt vrst.

Funkcije: osnovni pojmi; realne funkcije realne spremenljivke; elementarne funkcije; zveznost, enakomerna zveznost, zvezne funkcije na zaprtih intervalih; limite.

Odvod: geometrijski pomen, diferencial, pravila za odvajanje; odvodi elementarnih funkcij; izreki o srednji vrednosti, višji odvodi.

e; subsequences, accumulation points; Cauchy sequences; powers with real exponents.

Series: convergence; geometric series; series of positive terms, convergence criteria; alternating series; absolute and conditional convergence; addition and multiplication of series.

Functions: basic concepts; real functions of one real variable; elementary functions; continuity, uniform continuity, functions continuous on a closed interval; limits.

Differentiation: geometric interpretation, differential, differentiation formulas; derivatives of elementary functions; mean value theorems, higher derivatives.

#### **Temeljni literatura in viri / Readings:**

I. Vidav, Višja matematika I, II, DZS, Ljubljana, 1974.  
B. Hvala, Zbirka izpitnih nalog iz analize, DMFA, Ljubljana, 1996, 2000, 2007, 2016.

#### **Dodatna literatura /Additional Readings:**

M. Dobovišek, M. Hladnik, M. Omladič, Rešene naloge iz analize, DMFA, Ljubljana, 1980.  
E. Fischer, Intermediate real analysis, Springer, 1983.  
J. M. Howie, Real analysis, Springer, 2001.  
F. Morgan, , Real analysis, AMS, 2005.  
M. A. Robdera, A concise approach to mathematical analysis, Springer, 2003.  
W. Rudin, Principles of mathematical analysis, McGraw Hill Book Co., 1976.  
T. Tao, Analysis 1, 3rd edition, Hindustan Book Agency, New Delhi, 2014.

#### **Cilji in kompetence:**

Cilj in kompetence tega predmeta so, da študentje usvojijo osnovne pojme in metode realne analize, in jih uporabljajo pri nadaljnjem študiju matematike.

#### **Objectives and competences:**

The objectives and competences of this course are for students to acquire basic knowledge of real analysis, and to apply it in the study of mathematics.

#### **Predvideni študijski rezultati:**

Znanje in razumevanje:

Po zaključku tega predmeta bo študent sposoben

- razumeti osnovne pojme realne analize.
- razložiti in uporabljati osnovne izreke realne analize (realne funkcije realne spremenljivke, zveznost in limita funkcije, odvod funkcije).

#### **Intended learning outcomes:**

Knowledge and understanding:

On completion of this course the student will be able to

- understand basic concepts of real analysis.
- explain and use basic theorems from real analysis (real functions of real variable, continuity and limits of functions, differentiation),

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |  |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|
| <ul style="list-style-type: none"><li>• za reševanje problemov uporabiti realno analizo.</li></ul> <p>Prenosljive/ključne spretnosti in drugi atributi:</p> <ul style="list-style-type: none"><li>• Spretnosti komuniciranja: ustni zagovor izpita, pisno izražanje pri pisnem izpitu.</li><li>• Uporaba informacijske tehnologije: uporaba računalna ali računalniških aplikacij pri reševanju problemov.</li><li>• Reševanje problemov: reševanje problemov s pomočjo metod iz realne analize.</li></ul> |                                | <ul style="list-style-type: none"><li>• apply real analysis for problem solving.</li></ul> <p>Transferable/Key skills and other attributes:</p> <ul style="list-style-type: none"><li>• Communication skills: oral exam, manner of expression at written examination.</li><li>• Use of information technology: use of a calculator or computer applications for problem solving.</li><li>• Problem solving: problem solving using methods from real analysis</li></ul> |  |
| <b>Metode poučevanja in učenja:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                | <b>Learning and teaching methods:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                  |  |
| <ul style="list-style-type: none"><li>• Predavanja</li><li>• Teoretične vaje</li></ul>                                                                                                                                                                                                                                                                                                                                                                                                                     |                                | <ul style="list-style-type: none"><li>• Lectures</li><li>• Theoretical exercises</li></ul>                                                                                                                                                                                                                                                                                                                                                                             |  |
| <b>Načini ocenjevanja:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                | <b>Assessment:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                     |  |
| Pisni izpit                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Delež (v %) /<br>Weight (in %) | Written exam                                                                                                                                                                                                                                                                                                                                                                                                                                                           |  |
| Ustni izpit                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 50%<br>50%                     | Oral exam                                                                                                                                                                                                                                                                                                                                                                                                                                                              |  |

**Opombe:**  
Pisni izpit se lahko nadomesti s sprotnim ocenjevanjem (kolokviji) v enakem deležu (50%).

**Comments:**  
Written exam can be replaced by midterm examination in the same weight (50%).

**Reference nosilca / Lecturer's references:**

1. BREŠAR, Boštjan, DRAVEC, Tanja, HEDŽET, Jaka, SAMADI, Babak. Induced matching vs edge open packing: trees and product graphs. *Discrete mathematics*. [Print ed.]. Jul. 2025, vol. 348, iss. 7, [article no.] 114458, 19 str., graf. prikazi. ISSN 0012-365X. <https://www.sciencedirect.com/science/article/pii/S0012365X25000664>, [DiRROS - Digitalni repozitorij raziskovalnih organizacij Slovenije](#), DOI: [10.1016/j.disc.2025.114458](https://doi.org/10.1016/j.disc.2025.114458). [COBISS.SI-ID [228279299](#)]

2. BREŠAR, Boštjan, FERME, Jasmina, HOLUB, Přemysl, JAKOVAC, Marko, MELICHAROVÁ, Petra. SS-packing colorings of distance graphs with distance sets of cardinality 22. *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>, DiRROS - Digitalni repozitorij raziskovalnih organizacij Slovenije, DOI: [10.1016/j.amc.2024.129200](https://doi.org/10.1016/j.amc.2024.129200). [COBISS.SI-ID [216160771](https://cobiss.si/216160771)]
3. BREŠAR, Boštjan, HENNING, Michael A. Best possible upper bounds on the restrained domination number of cubic graphs. *Journal of graph theory*. Aug. 2024, vol. 106, iss. 4, str. 763–815, graf. prikazi. ISSN 0364-9024. <https://onlinelibrary.wiley.com/doi/10.1002/jgt.23095>, DiRROS - Digitalni repozitorij raziskovalnih organizacij Slovenije, DOI: [10.1002/jgt.23095](https://doi.org/10.1002/jgt.23095). [COBISS.SI-ID [199137795](https://cobiss.si/199137795)]
4. BREŠAR, Boštjan, HEDŽET, Jaka. Bootstrap percolation in strong products of graphs. *The Electronic journal of combinatorics*. [Online ed.]. 2024, vol. 31, iss. 4, article no. p4.35, 22 str. ISSN 1077-8926. <https://www.combinatorics.org/ojs/index.php/eljc/article/view/v31i4p35>, DiRROS - Digitalni repozitorij raziskovalnih organizacij Slovenije, DOI: [10.37236/11826](https://doi.org/10.37236/11826). [COBISS.SI-ID [215693827](https://cobiss.si/215693827)]
5. BREŠAR, Boštjan, CORNET, María Gracia, DRAVEC, Tanja, HENNING, Michael A. Bounds on zero forcing using (upper) total domination and minimum degree. *Bulletin of the Malaysian Mathematical Sciences Society*. Sep. 2024, vol. 47, iss. 5, [article no.] 143, 18 str. ISSN 0126-6705. <https://link.springer.com/article/10.1007/s40840-024-01744-x>, DOI: [10.1007/s40840-024-01744-x](https://doi.org/10.1007/s40840-024-01744-x). [COBISS.SI-ID [205078531](https://cobiss.si/205078531)]