

| UČNI NAČRT PREDMETA / COURSE SYLLABUS  |                |  |                      |                                    |                      |                 |  |
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| <b>Predmet:</b>  |                | Kardinalna aritmetika  |                      |                                    |                      |                 |  |
| <b>Course title:</b>   |                | Cardinal arithmetic  |                      |                                    |                      |                 |  |
| <b>Študijski program in stopnja</b>  |                | <b>Študijska smer</b>  |                      | <b>Letnik</b>                      |                      | <b>Semester</b> |  |
| <b>Study programme and level</b>   |                | <b>Study field</b>   |                      | <b>Academic year</b>               |                      | <b>Semester</b> |  |
| Magistrski študijski program<br>Matematika                                   |                | ni smeri   |                      | 1 ali 2                            |                      | prvi ali drugi  |  |
| Master's study programme<br>Mathematics                                      |                | none   |                      | 1 or 2                             |                      | first or second |  |
| <b>Vrsta predmeta / Course type</b>  |                |  |                      | izbirni                            |                      |                 |  |
| <b>Univerzitetna koda predmeta / University course code:</b>                 |                |  |                      | M2223                              |                      |                 |  |
| <b>Predavanja</b>  | <b>Seminar</b> | <b>Vaje</b>  | <b>Klinične vaje</b> | <b>Druge oblike</b>                | <b>Samost. delo</b>  | <b>ECTS</b>     |  |
| <b>Lectures</b>  | <b>Seminar</b> | <b>Tutorial</b>  | <b>work</b>          | <b>študija</b>                     | <b>Individ. work</b> |                 |  |
| 45   |                | 30   |                      |                                    | 105                  | 6               |  |
| <b>Nosilec predmeta / Lecturer:</b>  |                | prof. Andrej Bauer, prof. Bojan Peter Magajna, prof. Marko Petkovšek |                      |                                    |                      |                 |  |
| <b>Jeziki / Languages:</b>   |                | <b>Predavanja / Lectures:</b> slovenski/Slovene, angleški/English    |                      |                                    |                      |                 |  |
|  |                | <b>Vaje / Tutorial:</b> slovenski/Slovene, angleški/English          |                      |                                    |                      |                 |  |
| <b>Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:</b> |                |  |                      | <b>Prerequisites:</b>              |                      |                 |  |
|  |                |  |                      |                                    |                      |                 |  |
| <b>Vsebina:</b>  |                |  |                      | <b>Content (Syllabus outline):</b> |                      |                 |  |
|  |                |  |                      |                                    |                      |                 |  |

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| <p>Množice in razredi, aksiomi teorije množic, aksiom izbire, Zornova lema in uporaba, dobra urejenost, transfinitna indukcija, ordinalna števila in računanje z njimi, Schröder-Bernsteinov izrek, kardinalna števila in njihova aritmetika. V odvisnosti od časa še: filtri in ultrafiltri, velika kardinalna števila.</p> | <p>Sets and classes. Axioms of set theory. Axiom of choice, Zorn lemma and its applications, well ordering, transfinite induction, ordinal numbers and their arithmetic, Schröder-Bernstein theorem, cardinal numbers and their arithmetic. If time permits: filters and ultrafilters, large cardinal numbers.</p> |
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**Temeljni literatura in viri / Readings:**

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| <p>W. Just, M. Weese: Discovering Modern Set Theory I. AMS, 1991.<br/> P. R. Halmos: Naive set theory, Springer-Verlag, New York, 1974.<br/> H. Ebbinghaus et al.: Numbers, Springer-Verlag, New York, 1990.<br/> N. Prijatelj: Matematične strukture I, DMFA-založništvo, Ljubljana, 1996.</p> |
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**Cilji in kompetence:**

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| <p>Poglobliti temeljno znanje o aksiomatski teoriji množic ter se seznaniti z osnovami ordinalne in kardinalne aritmetike.</p> |
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**Objectives and competences:**

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| <p>Improvement of knowledge of axiomatic set theory and acquaintance with the basics of ordinal and cardinal arithmetic.</p> |
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**Predvideni študijski rezultati:**

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| <p>Znanje in razumevanje: Razumevanje in uporaba aksiomatske teorije množic ter ordinalne in kardinalne aritmetike.<br/> Uporaba: Teorija množic je temeljno matematično področje, ki priskrbi osnovni jezik za druga področja. V tem okviru so Zornova lema in ordinalna ter kardinalna števila nepogrešljiva orodja, uporabna širom matematike, zanimiva pa so tudi za nekatere filozofe.</p> <p>Refleksija:</p> <p>Teorija množic združuje vse matematične vede v celoto.</p> <p>Prenosljive spretnosti – niso vezane le na en</p> |
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**Intended learning outcomes:**

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| <p>Knowledge and understanding:<br/> Understanding and application of axiomatic set theory and ordinal and cardinal arithmetic.</p> <p>Application:</p> <p>Set theory is a fundamental branch of mathematics that provides the common language of mathematics. The Zorn lemma, ordinal and cardinal numbers are thus basic tools that find applications everywhere in mathematics. They are also interesting for philosophers.</p> <p>Reflection:</p> <p>Set theory provides a unifying approach to</p> |
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predmet:

Ker za razumevanje predmeta ne bo potrebno kako predhodno specialistično predznanje, bo zelo primeren tudi za učenje in vadbo matematičnega razmišljanja.

mathatics.

Transferable skills:

As no specific technical knowledge is necessary to follow the course, it is generally useful for development of mathematical technique and practice of mathematical thinking.

**Metode poučevanja in učenja:**

predavanja, vaje, domače naloge, konzultacije

**Learning and teaching methods:**

Lectures, exercises, homeworks, consultations

**Načini ocenjevanja:**

Delež (v %) /  
Weight (in %)

**Assessment:**

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| <p>Način (pisni izpit, ustno izpraševanje, naloge, projekt):<br/>izpit iz vaj (2 kolokvija ali pisni izpit)</p> <p>ustni izpit</p> <p>Ocene: 1-5 (negativno), 6-10 (pozitivno) (po Statutu UL)</p> | <p>50%</p> <p>50%</p> | <p>Type (examination, oral, coursework, project):<br/>2 midterm exams instead of written exam, written exam</p> <p>oral exam</p> <p>Grading: 1-5 (fail), 6-10 (pass) (according to the Statute of UL)</p> |
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**Reference nosilca / Lecturer's references:**

Andrej Bauer:

– BAUER, Andrej. A relationship between equilogical spaces and Type Two Effectivity. Mathematical logic quarterly, ISSN 0942-5616, 2002, vol. 48, suppl. 1, str. 1-15 [COBISS.SI-ID 12033369]

– AWODEY, Steve, BAUER, Andrej. Propositions as [Types]. Journal of logic and computation, ISSN 0955-792X, 2004, vol. 14, no. 4, str. 447-471 [COBISS.SI-ID 13374809]

– BAUER, Andrej, SIMPSON, Alex. Two constructive embedding-extension theorems with applications to continuity principles and to Banach-Mazur computability. *Mathematical logic quarterly*, ISSN 0942-5616, 2004, vol. 50, no. 4/5, str. 351-369 [COBISS.SI-ID 13378649]

Bojan Peter Magajna:

– MAGAJNA, Bojan. Infinitesimali. *Obzornik za matematiko in fiziko*, ISSN 0473-7466, 1983, let. 30, št. 2, str. 33-41 [COBISS.SI-ID 4773721]

– MAGAJNA, Bojan. The minimal operator module of a Banach module. *Proceedings of the Edinburgh Mathematical Society*, ISSN 0013-0915, 1999, let. 42, št. 1, str. 191-208 [COBISS.SI-ID 8567641]

– LE MERDY, Christian, MAGAJNA, Bojan. A factorization problem for normal completely bounded mappings. *Journal of functional analysis*, ISSN 0022-1236, 2001, vol. 181, no. 2, str. 313-345 [COBISS.SI-ID 10662489]

Marko Petkovšek:

– PETKOVŠEK, Marko, WILF, Herbert S., ZEILBERGER, Doron. *A=B*. Wellesley (Massachusetts): A. K. Peters, cop. 1996. VII, 212 str. ISBN 1-56881-063-6 [COBISS.SI-ID 4085337]

– PETKOVŠEK, Marko. Ambiguous numbers are dense. *American mathematical monthly*, ISSN 0002-9890, 1990, let. 97, št. 5, str. 408-411 [COBISS.SI-ID 8040537]

– PETKOVŠEK, Marko. Letter graphs and well-quasi-order by induced subgraphs. *Discrete Mathematics*, ISSN 0012-365X. [Print ed.], 2002, vol. 244, no. 1-3, str. 375-388 [COBISS.SI-ID 11414873]