Univerza v Mariboru

Fakulteta za naravoslovje in matematiko

| UČNI NAČRT PREDMETA / COURSE SYLLABUS | | | |
|---|---|---|---|
| **Predmet:** | **Algebra I** | | |
| **Course title:** | Algebra I | | |
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| **Študijski program in stopnja<br>Study programme and level** | **Študijska smer<br>Study field** | **Letnik<br>Academic year** | **Semester<br>Semester** |
| Matematika | | **2.** | **3.** |
| Mathematics | | **2.** | **3.** |

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|---|---|
| **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** |
|---|---|---|---|---|---|---|
| **45** | | **30** | | | **135** | **7** |

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| **Nosilec predmeta / Lecturer:** | Matej Brešar |

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

| **Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:** | **Prerequisites:** |
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| Opravljen izpit iz Linearne algebre.<br><br>Oba izpita, pisni in ustni, morata biti opravljena s pozitivno oceno.<br><br>Opravljen pisni izpit je pogoj za pristop k ustnemu izpitu. | Passed exam in Linear Algebra.<br><br>Each of the two exams, oral and written, must be assessed with a passing grade.<br><br>Passing the written exam is a prerequisite for taking the oral exam. |

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

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| Uvodni pojmi: binarne operacije, polgrupe, monoidi, cela števila.<br><br>Uvod v teorijo grup: definicija in primeri grup, podgrupe, odseki in Lagrangeov izrek, ciklične grupe, generatorji grup.<br><br>Uvod v teorijo kolobarjev: definicije in primeri kolobarjev, polj in algeber, podkolobarji (podpolja, podalgebre), karakteristika kolobarja, generatorji kolobarjev.<br><br>Homomorfizmi grup, homomorfizmi kolobarjev.<br><br>Kvocientne strukture: podgrupe edinke in kvocientne grupe, ideali in kvocientni kolobarji, izreki o izomorfizmu.<br><br>Moduli: definicija in primeri modulov, prosti moduli, tenzorski produkti. | Introductory notions: binary operations, semigroups, monoids, integers.<br><br>Introduction to group theory: definition and examples of groups, subgroups, cosets and Lagrange's theorem, cyclic groups, group generators.<br><br>Introduction to ring theory: definitions and examples of rings, fields and algebras, subrings (subfields, subalgebras), characteristic of a ring, ring generators.<br><br>Group homomorhisms, ring homomorphisms.<br><br>Quotient structures: normal subgroups and quotient groups, ideals and quotient rings, isomorphism theorems.<br><br>Modules: definition and examples of modules, free modules, tensor products. |

**Temeljna literatura in viri / Readings:**

- M. Brešar, Uvod v algebro, DMFA, 2018.
- M. Brešar, Undergraduate algebra. A unified approach, Springer, 2019.
- Vidav, Algebra, DMFA, 1980.

**Dodatna literatura / Additional Readings:**

- D. S. Dummit, R. M. Foote, Abstract Algebra, Prentice-Hall International, Inc., 1991.
- J. Gallian: Contemporary Abstract Algebra, Brooks/Cole, 2013.

| **Cilji in kompetence:** | **Objectives and competences:** |
|---|---|
| Spoznati temeljne algebraične pojme in abstraktni način razmišljanja. | Learning fundamental algebraic concepts and abstract thinking. |

| **Predvideni študijski rezultati:** | **Intended learning outcomes:** |
|---|---|
| Znanje in razumevanje:<br>Študent pozna in zmore pojasniti osnovne algebrske strukture, njihove podstrukture, homomorfizme in kvocientne struktur. | Knowledge and Understanding:<br>• The knowledge of and ability to explain basic algebraic structures and their substructures, homomorphisms, and quotient structures. |

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| Prenesljive/ključne spretnosti in drugi atributi:<br>• Pridobljena znanja so podlaga za študij skoraj vseh matematičnih področij. | Transferable/Key Skills and other attributes:<br>• The obtained knowledge is a prerequisite for a study of almost any area of mathematics. |

**Metode poučevanja in učenja:** **Learning and teaching methods:**

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| • Predavanja<br>• Seminarske vaje | • Lectures<br>• Tutorial |

**Načini ocenjevanja:** **Assessment:**

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| Pisni izpit<br>Ustni izpit | Delež (v %) / Weight (in %)<br><br>50%<br>50% | Written exam<br>Oral exam |

**Opombe:**
Pisni izpit se lahko nadomesti z vsaj dvema delnima testoma (sprotne obveznosti) v enakem deležu (50%).

**Comments:**
Written exam can be replaced by two or more partial tests (mid-term testing) in the same weight (50%).

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

1. BREŠAR, Matej. *Zero product determined algebras*. Cham: Birkhäuser: Springer, cop. 2021. VIII, 185 str. Frontiers in mathematics.
2. BREŠAR, Matej. Automorphisms and derivations of finite-dimensional algebras. *Journal of algebra*. June 2022, vol. 599, str. 104-121.
3. BREŠAR, Matej, GODOY, María Luisa Castillo, VILLENA, A. R. Maps preserving two-sided zero products on Banach algebras. *Journal of mathematical analysis and applications*. [Print ed.]. Nov. 2022, vol. 515, iss. 1, art. 126372 (16 str.)
4. BAJUK, Žan, BREŠAR, Matej. Two-sided zero product determined algebras. *Linear algebra and its applications*. [Print ed.]. June 2022, vol. 643, str. 125-136.
5. BREŠAR, Matej, ŠEMRL, Peter. The Waring problem for matrix algebras. *Israel journal of mathematics*. Mar. 2023, vol. 253, iss. 1, str. 381-405.