



Univerza v Mariboru

Fakulteta za naravoslovje
in matematiko

UČNI NAČRT PREDMETA / COURSE SYLLABUS

Predmet:	Algebra
Course title:	Algebra

Študijski program in stopnja Study programme and level	Študijska smer Study field	Letnik Academic year	Semester Semester
Matematika, 3. stopnja		1.	2.
Mathematics, 3 rd cycle		1 st	2 nd

Vrsta predmeta / Course type

Univerzitetna koda predmeta / University course code:

Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Klinične vaje work	Druge oblike študija	Samost. delo Individ. work	ECTS
45					225	9

Nosilec predmeta / Lecturer:

Jeziki / Languages:	Predavanja / Lectures:	Slovenski jezik; Slovene
	Vaje / Tutorial:	

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

Osnovno poznanje temeljnih algebrskih struktur: grup, vektorskih prostorov, kolobarjev in polj.

Prerequisites:

Basic knowledge of fundamental algebraic structures: groups, vector spaces, rings and fields.

Vsebina:

- Kategorije: osnovni pojmi in primeri.
- Grupe: osnovna teorija, struktura grup.
- Moduli: pomembni tipi modulov, verižni pogoji, tenzorski produkti.
- Komutativna algebra: razširitve polj in Galoisova teorija, komutativni kolobarji.
- Nekomutativna algebra: osnovna teorija, struktura nekomutativnih kolobarjev in algeber.
- Neasociativna algebra: osnovni pojmi in primeri.
- Nekatere izmed teh tem so obdelane podrobneje, druge pa le na osnovni ravni. Pri izboru se upoštevajo interesi in raziskovalne usmeritve študentov.

Content (Syllabus outline):

- Categories: basic concepts and examples.
- Groups: basic theory, the structure of groups.
- Modules: important types of modules, chain conditions, tensor products.
- Commutative algebra: field extensions and Galois theory, commutative rings.
- Noncommutative algebra: basic theory, the structure of noncommutative rings and algebras.
- Nonassociative algebra: basic concepts and examples.
- Some of these topics are treated in greater detail, and some of them only at a basic level. The selection depends on students' interests and their research orientation.

Temeljni literatura in viri / Readings:

- W. A. Adkins, S. H. Weintraub, Algebra. An approach via module theory. Springer-Verlag, 1999.
- M. Brešar, Introduction to Noncommutative Algebra, Springer, 2014.
- T. W. Hungerford, Algebra, Springer-Verlag, 1980.
- S. Lang, Algebra, Springer-Verlag, 1999.

Dodatna literatura / Additional Readings:

- Y. Bahturin, Basic structures of modern algebra, Kluwer AP, 1991.
- P. M. Cohn, Basic algebra. Groups, rings and fields, Springer-Verlag, 2003.
- P. A. Grillet, Abstract algebra, Springer-Verlag, 2007.
- I. M. Isaacs, Algebra. A graduate course, Brooks/Cole Publishing Company, 1994.
- A. W. Knap, Basic algebra, Springer-Verlag, 2006.

Cilji in kompetence:

- Doseči poglobljeno razumevanje teoretskih in metodoloških konceptov s področja Algebre
- Razviti sposobnost samostojnega razvijanja novega znanja s področja Algebre
- Razviti sposobnost za samostojno reševanje najzahtevnejših problemov iz Algebre
- Razviti sposobnost izboljševanja znanih in odkrivanja novih rezultatov s področja Algebre
- Zmožnost razvijanja kritične refleksije na področju Algebre
- Razviti zmožnost vodenja najzahtevnejših znanstvenoraziskovalnih projektov s širšega področja Algebre.

Objectives and competences:

- To achieve a deeper understanding of theoretical and methodological concepts of Algebra
- To develop the ability to independently develop new knowledge in the field of Algebra
- To develop the ability for solving the most challenging problems in Algebra
- To develop the ability of improving known results as well as obtaining new results in Algebra
- Ability to develop critical reflection in Algebra
- To develop the ability to lead the most challenging scientific research projects in the wider field of Algebra

Predvideni študijski rezultati:**Znanje in razumevanje:**

- poznavanje temeljnih algebrskih področij;
- razumevanje zahtevnejših algebrskih pojmov.

Prenesljive/ključne spretnosti in drugi atributi:

- podlaga za raziskovalno delo na področju algebre;
- pridobljeno znanje za uporabo algebre na drugih matematičnih področjih.

Intended learning outcomes:**Knowledge and understanding:**

- knowledge of fundamental topics in algebra;
- understanding complex algebraic concepts.

Transferable/Key Skills and other attributes:

- a basis for research in algebra;
- knowledge needed for applying algebra to other mathematical areas.

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Metode poučevanja in učenja:

- predavanja;
- priprava seminarja;
- konzultacije;
- samostojni študij.

Learning and teaching methods:

- lectures;
- seminar work;
- consultations;
- self-study.

Načini ocenjevanja:	Delež (v %) / Weight (in %)	Assessment:
Seminarska naloga	50 %	Seminar paper
Teoretični izpit	50 %	Theoretical exam

Reference nosilca / Lecturer's references:

1. BREŠAR, Matej, ŠEMRL, Peter. The Waring problem for matrix algebras. *Israel journal of mathematics*. Mar. 2023, vol. 253, iss. 1, str. 381-405. ISSN 0021-2172.
<https://link.springer.com/article/10.1007/s11856-022-2366-7>, DOI: [10.1007/s11856-022-2366-7](https://doi.org/10.1007/s11856-022-2366-7).
[COBISS.SI-ID [149854467](#)], [JCR]
kategorija: 1A2
2. BREŠAR, Matej, GODOY, M. L. C. Weighted Jordan homomorphisms. *Linear and multilinear algebra*. 2023, vol. 71, no. 8, str. 1265-1279. ISSN 0308-1087.
<https://www.tandfonline.com/doi/full/10.1080/03081087.2022.2059434>, DOI: [10.1080/03081087.2022.2059434](https://doi.org/10.1080/03081087.2022.2059434). [COBISS.SI-ID [152079875](#)], [JCR]
kategorija: 1A2
3. BREŠAR, Matej. Automorphisms and derivations of finite-dimensional algebras. *Journal of algebra*. June 2022, vol. 599, str. 104-121. ISSN 0021-8693.
<https://www.sciencedirect.com/science/article/pii/S0021869322000746>, DOI: [10.1016/j.jalgebra.2022.02.010](https://doi.org/10.1016/j.jalgebra.2022.02.010). [COBISS.SI-ID [100274435](#)], [JCR]
kategorija: 1A3
4. BREŠAR, Matej, ŠEMRL, Peter. The Waring problem for matrix algebras. *Israel journal of mathematics*. Mar. 2023, vol. 253, iss. 1, str. 381-405. ISSN 0021-2172.
<https://link.springer.com/article/10.1007/s11856-022-2366-7>, DOI: [10.1007/s11856-022-2366-7](https://doi.org/10.1007/s11856-022-2366-7).
[COBISS.SI-ID [149854467](#)], [JCR]
kategorija: 1A2
5. BREŠAR, Matej, SHULMAN, Victor S. On, around, and beyond Frobenius' theorem on division algebras. *Linear and Multilinear Algebra*. 2022, vol. 70, iss. 7, str. 1369-1381. ISSN 0308-1087.
<https://www.tandfonline.com/doi/full/10.1080/03081087.2020.1761281>, DOI: [10.1080/03081087.2020.1761281](https://doi.org/10.1080/03081087.2020.1761281)

[10.1080/03081087.2020.1761281](#). [COBISS.SI-ID [106388227](#)], [[JCR](#)]
kategorija: 1A2