



Univerza v Mariboru

Fakulteta za naravoslovje  
in matematiko

### UČNI NAČRT PREDMETA / COURSE SYLLABUS

<b>Predmet:</b>	Algebra
<b>Course title:</b>	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 <sup>rd</sup> cycle		1 <sup>st</sup>	2 <sup>nd</sup>

Vrsta predmeta / Course type

obvezni ali izbirni/compulsory or  
elective

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:

Matej Brešar

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.
- 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.
- T. W. Hungerford, Algebra, Springer-Verlag, 1980.
- I. M. Isaacs, Algebra. A graduate course, Brooks/Cole Publishing Company, 1994.
- A. W. Knap, Basic algebra, Springer-Verlag, 2006.
- S. Lang, Algebra, Springer-Verlag, 2002.

**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.

**Prenosljive/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.

**Metode poučevanja in učenja:**

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

**Learning and teaching methods:**

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

Delež (v %) /

**Načini ocenjevanja:**

Weight (in %)

**Assessment:**

Način (pisni izpit, ustno izpraševanje, naloge, projekt):		Type (examination, oral, coursework, project):
Seminarsko predavanje	<b>20%</b>	Seminar talk
Pisni izdelek	<b>30%</b>	Written work
Ustni izpit	<b>50%</b>	Oral Examination

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

1. ALAMINOS, J., BREŠAR, Matej, EXTREMERA, J., VILLENA, A. R. Zero Lie product determined Banach algebras. *Studia Mathematica*, ISSN 0039-3223, 2017, vol. 239, no. 2, str. 189-199. <http://dx.doi.org/10.4064/sm8734-4-2017>, doi: [10.4064/sm8734-4-2017](https://doi.org/10.4064/sm8734-4-2017). [COBISS.SI-ID [18099801](#)], [JCR] kategorija: 1A3
2. BREŠAR, Matej. Functional identities and rings of quotients. *Algebras and representation theory*, ISSN 1386-923X, 2016, vol. 19, iss. 6, str. 1437-1450. <http://dx.doi.org/10.1007/s10468-016-9625-4>. [COBISS.SI-ID [17811289](#)], [JCR] kategorija: 1A3
3. BREŠAR, Matej. Finite dimensional zero product determined algebras are generated by idempotents. *Expositiones mathematicae*, ISSN 0723-0869, 2016, vol. 34, iss. 1, str. 130-143. <http://dx.doi.org/10.1016/j.exmath.2015.07.002>. [COBISS.SI-ID [17615193](#)], [JCR] kategorija: 1A2
4. BREŠAR, Matej. Functional identities on tensor products of algebras. *Journal of algebra*, ISSN 0021-8693, 2016, vol. 455, str. 108-136. <http://dx.doi.org/10.1016/j.jalgebra.2016.02.012>. [COBISS.SI-ID [17625945](#)], [JCR] kategorija: 1A3
5. BREŠAR, Matej. Jordan  $\{g,h\}$ -derivations on tensor products of algebras. *Linear and Multilinear Algebra*, ISSN 0308-1087, 2016, vol. 64, no. 11, str. 2199-2207. <http://dx.doi.org/10.1080/03081087.2016.1145184>. [COBISS.SI-ID [17810009](#)], [JCR] kategorija: 1A1