



Univerza v Mariboru

Fakulteta za naravoslovje  
in matematiko

### UČNI NAČRT PREDMETA / COURSE SYLLABUS

<b>Predmet:</b>	<b>Poglavja iz algebre</b>
<b>Course title:</b>	<b>Topics in Algebra</b>

Študijski program in stopnja Study programme and level	Študijska smer Study field	Letnik Academic year	Semester Semester
Matematika, 2. stopnja	Modul S2	1. ali 2.	1. ali 3.
Mathematics, 2 <sup>nd</sup> cycle	Module S2	1. or 2.	1. or 3.

**Vrsta predmeta / Course type**

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

Predavanja Lectures	Seminar Seminar	Sem. vaje Tutorial	Lab. vaje Laboratory work	Teren. vaje Field work	Samost. delo Individ. work	ECTS
60		45			165	9

**Nosilec predmeta / Lecturer:**

<b>Jeziki / Languages:</b>	<b>Predavanja / Lectures:</b>	SLOVENSKO/SLOVENE
	<b>Vaje / Tutorial:</b>	SLOVENSKO/SLOVENE

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

Poznavanje osnov teorije grup in teorije kolobarjev.

**Vsebina:**

Galoisova teorija: osnovni izrek Galoisove teorije, rešljivost polinomskih enačb z radikali, osnovni izrek algebre.

Moduli: osnovni pojmi in primeri, posebni razredi modulov (prosti, projektivni, enostavni itd.), moduli nad glavnimi kolobarji.

Tenzorski produkti vektorskih prostorov, modulov in algeber.

**Prerequisites:**

Knowledge of basic group theory and basic ring theory.

**Content (Syllabus outline):**

Galois Theory: Fundamental Theorem of Galois Theory, solvability of polynomial equations by radicals, Fundamental Theorem of Algebra.

Modules: basic concepts and examples, special classes of modules (free, projective, simple, etc.), modules over principal ideal domains.

Tensor products of vector spaces, modules and algebras.

Končno-razsežne algebre: Frobeniusov izrek, končni obsegi, Wedderburnova strukturna teorija.

Finite-dimensional algebras: Frobenius' Theorem, finite division rings, Wedderburn's Structure Theory.

**Temeljni literatura in viri / Readings:**

M. Brešar, Introduction to Noncommutative Algebra, Springer, 2014.  
 M. Brešar, Undergraduate Algebra. A Unified Approach, Springer, 2019.  
 M. Brešar, Uvod v algebro, DMFA, 2018.  
 D. Dummit, R. Foote, Abstract Algebra, Prentice-Hall, 1991.  
 T. W. Hungerford, Algebra, Springer-Verlag, 1980.

**Cilji in kompetence:**

Poglobiti znanje osnovnih področij abstraktne algebre.

**Objectives and competences:**

Deepening the knowledge of fundamental areas of abstract algebra.

**Predvideni študijski rezultati:**

Znanje in razumevanje:

Po zaključku predmeta bo študent seznanjen s klasično abstraktno algebro in s tem pripravljen na študij njenih modernih vsebin.

Prenosljive/ključne spretnosti in drugi atributi:

Algebraične strukture so pojavljajo na vseh matematičnih področjih, zato mora biti z njimi seznanjen vsak matematik.

**Intended learning outcomes:**

Knowledge and Understanding:

On the completion of the course, the student will be acquainted with the classical abstract algebra and capable of tackling its modern areas.

Transferable/Key Skills and other attributes:

Algebraic structures occur in all mathematical areas, so their knowledge is a necessity for every mathematician.

**Metode poučevanja in učenja:**

- Predavanja
- Seminarske vaje

**Learning and teaching methods:**

- Lectures
- Tutorial

**Načini ocenjevanja:**

Način (pisni izpit, ustno izpraševanje, naloge, projekt):

Pisni izpit  
 Ustni izpit

Vsaka izmed naštetih obveznosti mora biti opravljena s pozitivno oceno.

Delež (v %) /  
 Weight (in %)

50%  
 50%

Type (examination, oral, coursework, project):

Written exam  
 Oral exam

A passing grade is required for each of the two exams.

Opravljen pisni izpit – problemi je pogoj  
za pristop k ustnemu izpitu – teorija.

Passing the written test is  
required for taking the oral 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. [COBISS.SI-ID 149854467]
2. 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. [COBISS.SI-ID 100274435]
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.). ISSN 0022-247X. <https://www.sciencedirect.com/science/article/pii/S0022247X22003869>, DOI: 10.1016/j.jmaa.2022.126372. [COBISS.SI-ID 110484227]
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. ISSN 0024-3795. <https://www.sciencedirect.com/science/article/pii/S0024379522000659>, DOI: 10.1016/j.laa.2022.02.022. [COBISS.SI-ID 100272387]
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. [COBISS.SI-ID 106388227]