UČNI NAČRT PREDMETA / COURSE SYLLABUS (leto / year 2016/17)			
Predmet:	Komutativna algebra		
Course title:	Commutative algebra		
Študijski program in stopnja **Study programme and level**	**Študijska smer** **Study field**	**Letnik** **Academic year**	**Semester** **Semester**
Magistrski študijski program Finančna matematika	ni smeri	1 ali 2	prvi ali drugi
Master's study programme Financial Mathematics	none	1 or 2	first or second

Vrsta predmeta / Course type	izbirni / elective
Univerzitetna koda predmeta / University course code:	M2221

Predavanja **Lectures**	**Seminar** **Seminar**	**Vaje** **Tutorial**	**Klinične vaje** **work**	**Druge oblike** **študija**	**Samost. delo** **Individ. work**	**ECTS**
45		**30**			**105**	**6**

Nosilec predmeta / Lecturer:	prof. dr. David Dolžan, prof. dr. Tomaž Košir

Jeziki / Languages:	**Predavanja / Lectures:**	slovenski / Slovene, angleški / English
	Vaje / Tutorial:	slovenski / Slovene, angleški / English

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	**Prerequisites:**
Vpis v letnik študija.	Enrolment in the programme.

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

Osnovni del: Komutativni kolobar, spekter kolobarja. Nilradikal in Jacobsonov radikal. Moduli, podmoduli in homomorfizmi. Operacije na modulih, direktna vsota in produkt. Končno generirani moduli. Eksaktna zaporedja. Tenzorski produkt modulov in njegove eksaktnostne lastnosti. Razširitev in zožitev skalarjev. Algebre in njihovi tenzorski produkti. Noetherski kolobarji, Hilbertov izrek o bazi. Izrek o noetherski normalizaciji. Hilbertov izrek o ničlah, topologija Zariskega. Kolobarji ulomkov, lokalizacija. Primarni razcep. Prirejeni praideali, primarne komponente, izreka o enoličnosti. Izbirne vsebine: Valuacijski kolobarji. Filtracija. Artin-Reesova lema. Napolnitev in Henselova lema. Uvod v teorijo dimenzije. Polinomi, Gröbnerjeve baze.	Basics: Commutative ring, spectrum. Nilradical and Jacobson radical. Modules, submodules and homomorphisms. Module operations, direct sum and product. Finitely generated modules. Exact sequences. Tensor product of modules and its exactness properties. Restriction and extension of scalars. Algebras and their tensor products. Noetherian rings, Hilbert's Basis theorem. Noetherian normalization theorem. Hilbert's Nullstellensatz, Zariski topology. Rings of fractions, localization. Primary decomposition. Associated prime ideals, primary components, uniqueness theorems. Optional themes: Valuation rings. Filtration. Artin-Rees lemma. Completion and Hensel's lemma. Introduction to the dimension theory. Polynomials, Gröbner bases.

Temeljni literatura in viri / Readings:

M. Reid: Undergraduate Commutative Algebra, Cambridge Univ. Press, Cambridge, 1995.

M. F. Atiyah, I. G. MacDonald: Introduction to Commutative Algebra, Addison-Wesley, Reading, 1994.

D. Cox, J. Little, D. O'Shea: Ideals, Varieties and Algorithms : An Introduction to Computational Algebraic Geometry and Commutative Algebra, 2nd edition, Springer, New York, 2005.

N. Lauritzen: Concrete Abstract Algebra: From Numbers to Gröbner Bases, Cambridge University

Press, Cambridge, 2003.

Cilji in kompetence:

Slušatelj spozna osnove teorije komutativne algebre. Dopolni vsebine, ki jih sreča pri algebraičnih predmetih na dodiplomskem študiju. Pridobljeno znanje praktično utrdi z domačimi nalogami in samostojnim reševanjem problemov.

Objectives and competences:

The student learns the basics of the theory of commutative algebra and upgrades notions and theories that were met during the undergraduate algebraic courses. The knowledge is consolidated by homeworks and individual problem solving exercises.

Predvideni študijski rezultati:

Znanje in razumevanje: Poznavanje osnovnih pojmov in izrekov komutativne algebre in njihovo prepoznavanje v drugih vejah matematike.

Uporaba: V algebraični geometriji in algebraični teoriji števil.

Refleksija: Razumevanje teorije na podlagi primerov in uporabe.

Prenosljive spretnosti – niso vezane le na en predmet: Formulacija problemov v primernem jeziku, reševanje in analiza doseženega na primerih, prepoznavanje algebraičnih struktur v geometriji in teoriji števil.

Intended learning outcomes:

Knowledge and understanding: Learning the basic notions and theorem of commutative algebra and recognizing the concepts in other areas of mathematics.

Application: In algebraic geometry and algebraic number theory.

Reflection: Understanding the theory on the basis of examples and applications.

Transferable skills: Formulations of problems in appropriate language, solving and analysing the results on examples, recognizing algebraic structures in geometry and number theory.

Metode poučevanja in učenja:

Learning and teaching methods:

predavanja, vaje, domače naloge, konzultacije	Lectures, exercises, homeworks, consultations

Načini ocenjevanja:	Delež (v %) / Weight (in %)	**Assessment:**
Način (domače naloge, pisni izpit, ustno izpraševanje, naloge):		Type (homeworks, examination, oral, coursework, project):
domače naloge		homeworks
pisni izpit	20%	written exam
ustni izpit	40%	oral exam
Ocene: 1-5 (negativno), 6-10 (pozitivno) (po Statutu UL)	40%	Grading: 1-5 (fail), 6-10 (pass) (according to the Statute of UL)

Reference nosilca / Lecturer's references:

David Dolžan:

DOLŽAN, David, OBLAK, Polona. The zero-divisor graphs of rings and semirings. International journal of algebra and computation, ISSN 0218-1967, 2012, vol. 22, iss. 4, 1250033 (20 str.). [COBISS.SI-ID 16312921]

DOLŽAN, David, KOKOL-BUKOVŠEK, Damjana, OBLAK, Polona. Diameters of commuting graphs of matrices over semirings. Semigroup forum, ISSN 0037-1912, 2012, vol. 84, no. 2, str. 365-373. [COBISS.SI-ID 16313433]

DOLŽAN, David, OBLAK, Polona. Commuting graphs of matrices over semirings. V: 1st Montreal Workshop on Idempotent and Tropical Mathematics, June 29 to July 3, 2009, University of Montreal, Canada. Special Issue dedicated to 1st Montreal Workshop, (Linear algebra and its applications, ISSN 0024-3795, Vol. 436, iss. 7). Amsterdam [etc.]: Elsevier, 2011, str. 1657-1665. [COBISS.SI-ID 15585113]

Tomaž Košir:

GRUNENFELDER, Luzius, KOŠIR, Tomaž, OMLADIČ, Matjaž, RADJAVI, Heydar. Finite groups with submultiplicative spectra. Journal of Pure and Applied Algebra, ISSN 0022-4049. [Print ed.], 2012,

vol. 216, iss. 5, str. 1196-1206. [COBISS.SI-ID 16183385]

BUCKLEY, Anita, KOŠIR, Tomaž. Plane curves as Pfaffians. Annali della Scuola normale superiore di Pisa, Classe di scienze, ISSN 0391-173X, 2011, vol. 10, iss. 2, str. 363-388. [COBISS.SI-ID 15928409]

KOŠIR, Tomaž, OBLAK, Polona. On pairs of commuting nilpotent matrices. Transformation groups, ISSN 1083-4362, 2009, vol. 14, no. 1, str. 175-182. [COBISS.SI-ID 15077977]