

| UČNI NAČRT PREDMETA / COURSE SYLLABUS (leto / year 2016/17)                  |                           |   |                              |                                    |                                      |                             |
|--|---------------------------|---|------------------------------|------------------------------------|--------------------------------------|-----------------------------|
| <b>Predmet:</b>  |                           | Uvod v algebraično geometrijo   |                              |                                    |                                      |                             |
| <b>Course title:</b>   |                           | Introduction to algebraic geometry                                    |                              |                                    |                                      |                             |
| <b>Študijski program in stopnja</b><br>Study programme and level             |                           | <b>Študijska smer</b><br>Study field                                  |                              | <b>Letnik</b><br>Academic year     |                                      | <b>Semester</b><br>Semester |
| Magistrski študijski program<br>Finančna matematika                          |                           | ni smeri  |                              | 1 ali 2                            |                                      | prvi ali drugi              |
| Master's study programme<br>Financial Mathematics                            |                           | none  |                              | 1 or 2                             |                                      | first or second             |
| <b>Vrsta predmeta / Course type</b>  |                           |   |                              | izbirni / elective                 |                                      |                             |
| <b>Univerzitetna koda predmeta / University course code:</b>                 |                           |   |                              | M2310                              |                                      |                             |
| <b>Predavanja</b><br>Lectures  | <b>Seminar</b><br>Seminar | <b>Vaje</b><br>Tutorial   | <b>Klinične vaje</b><br>work | <b>Druge oblike</b><br>študija     | <b>Samost. delo</b><br>Individ. work | <b>ECTS</b>                 |
| 45   |                           | 30  |                              |                                    | 105                                  | 6                           |
| <b>Nosilec predmeta / Lecturer:</b>  |                           | prof. dr. Tomaž Košir   |                              |                                    |                                      |                             |
| <b>Jeziki / Languages:</b>   |                           | <b>Predavanja / Lectures:</b> slovenski / Slovene, angleški / English |                              |                                    |                                      |                             |
|  |                           | <b>Vaje / Tutorial:</b> slovenski / Slovene, angleški / English       |                              |                                    |                                      |                             |
| <b>Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:</b> |                           |   |                              | <b>Prerequisites:</b>              |                                      |                             |
| Vpis v letnik študija.   |                           |   |                              | Enrolment in the programme.        |                                      |                             |
| <b>Vsebina:</b>  |                           |   |                              | <b>Content (Syllabus outline):</b> |                                      |                             |

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| <p>Osnovni del:</p> <p>Afine raznoterosti. Hilbertov izrek o ničlah. Kolobar polinomskih funkcij. Racionalne funkcije.</p> <p>Lokalne lastnosti ravninskih krivulj.</p> <p>Projektivne raznoterosti. Regularne in racionalne funkcije.</p> <p>Projektivne ravninske krivulje. Bezoutov izrek. Izrek Maxa Noetherja.</p> <p>Preslikave med raznoterostmi. Resolucije singularnosti krivulj.</p> <p>Hilbertov polinom in Hilbertova funkcija.</p> <p>Delitelji na raznoterostih.</p> <p>Krivulje. Ravninske kubične krivulje. Linearni sistemi na krivulji. Projektivne vložitve krivulj.</p> <p>Izbirne vsebine:</p> <p>Riemann-Rochov izrek.</p> | <p>Fundamental part:</p> <p>Affine varieties. Hilbert Nullstellensatz.</p> <p>Ring of polynomial functions. Rational functions.</p> <p>Local properties of plane curves.</p> <p>Projective varieties. Regular and rational functions.</p> <p>Projective plane curves. Bezout's Theorem.</p> <p>Max Noether Theorem.</p> <p>Affine and rational maps. Resolutions of singularities.</p> <p>Hilbert polynomial and Hilbert function.</p> <p>Divisors on varieties.</p> <p>Curves. Plane cubic curves. Linear systems on curves. Projective embeddings of curves.</p> <p>Elective topics:</p> <p>Riemann-Roch Theorem.</p> |
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**Temeljni literatura in viri / Readings:**

- B. Hassett. Introduction to algebraic geometry. Cambridge Univ. Press, 2007.
- M. C. Beltrametti, E. Carletti, D. Gallarati, G. Monti Bragadin. Lectures on Curves, Surfaces and Projective Varieties. A Classical View of Algebraic Geometry, EMS Text-books in Mathematics, 2009.
- I. Shafarevich: Basic Algebraic Geometry I : Varieties in Projective Space, 2nd edition, Springer, Berlin, 1994.
- K. Hulek: Elementary Algebraic Geometry, AMS, Providence, 2003.
- W. Fulton: Algebraic Curves, Addison-Wesley, Redwood City, 1989.
- J. Harris: Algebraic Geometry : A First Course, Springer, New York, 1995.

**Cilji in kompetence:**

**Objectives and competences:**

Študent se spozna z osnovnimi pojmi in izreki algebraične geometrije.

Student masters basic concepts and tools of algebraic geometry.

**Predvideni študijski rezultati:**

Znanje in razumevanje: Poznavanje pojmov in izrekov algebraične geometrije in njihovo prepoznavanje v drugih vejah matematike.

Uporaba: V področjih matematike, ki delajo z geometričnimi objekti, v teoretični fiziki, in drugje.

Refleksija: Razumevanje teorije na podlagi primerov in uporabe.

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

**Intended learning outcomes:**

Knowledge and understanding: Understanding of basic concepts and theorems of algebraic geometry, and their role in some other areas.

Application: In the areas of mathematics that deal with geometric objects, in theoretical physics, and elsewhere.

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

Transferable skills: Formulation and solution of problems in an appropriate setup, solution and analysis of the results in examples, recognizing algebraic structure in geometric objects.

**Metode poučevanja in učenja:**

predavanja, vaje, domače naloge, konzultacije

**Learning and teaching methods:**

Lectures, exercises, homeworks, consultations

**Načini ocenjevanja:**

Delež (v %) /

Weight (in %)

**Assessment:**

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

50%

Type (examination, oral, coursework, project):

50%

izpit iz vaj (2 kolokvija ali pisni izpit)

2 midterm exams instead of written exam, written exam

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| <p>ustni izpit</p> <p>Ocene: 1-5 (negativno), 6-10 (pozitivno)<br/>(po Statutu UL)</p> |  | <p>oral exam</p> <p>Grading: 1-5 (fail), 6-10 (pass) (according to the Statute of UL)</p> |
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**Reference nosilca / Lecturer's references:**

Tomaž Košir:

GRUNENFELDER, Luzius, KOŠIR, Tomaž. Geometric aspect of multiparameter spectral theory. Transactions of the American Mathematical Society, ISSN 0002-9947, 1998, let. 350, št. 6, str. 2525-2546. [COBISS.SI-ID 8449113]

KOŠIR, Tomaž, SETHURAMAN, B. A. Determinantal varieties over truncated polynomial rings. Journal of Pure and Applied Algebra, ISSN 0022-4049. [Print ed.], 2005, vol. 195, no. 1, str. 75-95. [COBISS.SI-ID 13266265]

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]