



Univerza v Mariboru

Fakulteta za naravoslovje  
in matematiko

**UČNI NAČRT PREDMETA / COURSE SYLLABUS**

<b>Predmet:</b>	<b>Ravninska in prostorska geometrija</b>
<b>Course title:</b>	Plane and solid geometry

Študijski program in stopnja Study programme and level	Študijska smer Study field	Letnik Academic year	Semester Semester
Izobraževalna matematika – dvopredmetni, 1. stopnja		2.	3.
Educational mathematics – Double- major, 1 <sup>st</sup> degree		2.	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
45		30	15		90	6

Nosilec predmeta / Lecturer:

Jeziki / Predavanja / Lectures:   
Languages: Vaje / Tutorial:

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

Jih ni.

**Prerequisites:**

There are none.

**Vsebina:**

Trikotnik. Cevov izrek. Znamenite točke trikotnika. Eulerjeva premica, krožnica devetih točk. Simsonova premica, Ptolomejev izrek.

Krožnica. Potenca točke glede na krožnico, potenčna premica in potenčno središče. Eulerjev izrek.

Štirikotniki. Varignonov izrek. Tetivni štirikotniki. Napoleonovi trikotniki. Ploščina. Brahmaguptova in Heronova formula.

Menelajev izrek in primeri uporabe.

Transformacije ravnine: izometrije (translacije, rotacije, zrcaljenja), raztegi. Inverzija.

**Content (Syllabus outline):**

Triangle. Ceva's theorem. Basic triangle centers. Euler line, Nine-point circle. Simson line, Ptolemy's theorem.

Circle. Power of a point with respect to a circle, radical axis, radical center. Euler's theorem.

Quadrangles. Varignon's theorem. Cyclic quadrangles. Napoleon triangles. Area. Brahmagupta's formula. Heron's formula.

Menelaus' theorem and applications.

Transformations: isometries (translation, rotation, reflection), dilatation. Inversion.

Telesa. Prizma, piramida, valj, stožec, krogla. Volumen. Koti v telesih. Prostorski kot. Eulerjeva formula. Pravilna telesa.

Solid. Prism, Cylinder, Cone, Sphere. Volume. Angles in solids. Solid angles. Euler polyhedral formula. Platonic solids.

### Temeljni literatura in viri / Readings:

H. S. M. Coxeter, S. L. Greitzer: *Geometry Revisited*. Washington: MAA, 1967.

C. Kimberling, *Geometry in action, a discovery approach using the Geometer's sketchpad*, Key College Publishing, Emeryville, 2003.

D. Palman: *Trokut i kružnica*. Zagreb: Element, 1994.

D. Palman: *Geometrijske konstrukcije*. Zagreb: Element, 1996.

D. Palman: *Stereometrija*. Zagreb: Element, 2002.

Bogomolny, A. "Regular Polyhedra." [http://www.cut-the-knot.com/do\\_you\\_know/polyhedra.html](http://www.cut-the-knot.com/do_you_know/polyhedra.html).

### Cilji in kompetence:

Študent se seznani z osnovami pojmi in rezultati geometrije trikotnika, s transformacijami v ravnini in njihovo uporabo pri geometrijskih konstrukcijah ter z osnovnimi pojmi prostorske geometrije.

### Objectives and competences:

Knowing fundamental concepts and results from triangle geometry. Understanding transformations of the plane and their applications to geometric constructions. Knowing fundamental results from solid geometry.

### Predvideni študijski rezultati:

Znanje in razumevanje:

- Študent obvlada pojme in rezultate iz ravninske in prostorske geometrije v razširjenem srednješolskem obsegu.
- Študent vadi dokazovanje trditev iz ravninske geometrije in s tem spoznava drugačen, manj računski pristop k dokazovanju.
- Študent obvlada osnovne geometrijske konstrukcije, tako z uporabo klasičnih orodij, kot z uporabo računalniških geometrijskih orodij.
- Študent spoznava pomen transformacij, ki konkretne geometrijske situacije preslikajo v bolj ugodne.

Prenesljive/ključne spretnosti in drugi atributi:

- Problemski pristop, kjer z računalniškim eksperimentiranjem tvorimo hipoteze in jih kasneje bodisi dokažemo bodisi ovržemo s protiprimeri.
- Dojemanje transformacij kot opcije za pretvorbo matematične situacije v drugo situacijo, ki je udobnejša za obravnavo.

### Intended learning outcomes:

Knowledge and Understanding:

- Enlarging student's high school knowledge about the concepts and results from plane and solid geometry.
- Practicing the geometrical, noncomputational approach to proving results in plane geometry.
- Being able to accomplish basic geometric constructions applying classical tools as well as modern geometric computer tools.
- Understanding the importance of transformations of the plane mapping geometric configurations into more convenient ones.

Transferable/Key Skills and other attributes:

- Problem solving approach, consisted of computer experimentation, proposing hypothesis and finding either the proof or the counterexample.
- Understanding the concept of transformations as tools to convert a certain mathematical situation into a more convenient one.

### Metode poučevanja in učenja:

- Predavanja
- Teoretične vaje
- Laboratorijske vaje v računalniški učilnici
- Individualno delo

### Learning and teaching methods:

- Lectures
- Theoretical exercises
- Exercises in computer room.
- Individual work

**Načini ocenjevanja:****Assessment:**

	Delež (v %) / Weight (in %)	
<p><u>Sprotno preverjanje:</u> Opravljene geometrijske konstrukcije pri laboratorijskih vajah v računalniški učilnici.</p> <p><u>Izpit:</u> Pisni izpit – problemi Ustni izpit</p> <p>Vsaka izmed naštetih obveznosti mora biti opravljena s pozitivno oceno.</p> <p>Opravljene sprotne obveznosti so pogoj za pristop k pisnemu izpitu – problemi. Opravljen pisni izpit – problemi je pogoj za pristop k ustnemu izpitu.</p> <p>Pisni izpit – problemi se lahko nadomesti z dvema delnima testoma (sprotne obveznosti).</p>	<p>10%</p> <p>45%</p> <p>45%</p>	<p><u>Mid-term testing:</u> Accomplished geometric constructions at the exercises in computer room.</p> <p><u>Exams:</u> Written exam – problems Oral exam</p> <p>Each of the mentioned assessments must be assessed with a passing grade.</p> <p>Passing grades of mid-term testing is required for taking the written exam – problems. Passing grade of written exam – problems is required to take the oral exam.</p> <p>Written exam – problems can be replaced with two mid-term tests.</p>

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

1. HVALA, Bojan. Diophantine Steiner triples. *Math. Gaz.*, March 2011, vol. 95, no. 532, str. 31-39. [COBISS.SI-ID 18256648]
2. HVALA, Bojan. Diophantine Steiner triples and Pythagorean-type triangles. *Forum geom.*, 2010, vol. 10, str. 93-97.  
<http://forumgeom.fau.edu/FG2010volume10/FG201010.pdf>. [COBISS.SI-ID 15669337]
3. HVALA, Bojan. Modernizing mathematics education in Slovenia : a teacher friendly approach. V: LAMANAUSKAS, Vincentas (ur.). *Challenges of science, mathematics and technology teacher education in Slovenia*, (Problems of education in the 21st century, vol. 14). Siauliai: Scientific Methodological Center Scientia Educologica, 2009, str. 34-43. [COBISS.SI-ID 17351944]
4. HVALA, Bojan. Generalized Lie derivations in prime rings. *Taiwan. j. math.*, dec. 2007, vol. 11, iss. 5, str. 1425-1430. [COBISS.SI-ID 15969288]
5. BREŠAR, Matej, HVALA, Bojan. On additive maps of prime rings. II. *Publ. math. (Debr.)*, 1999, letn. 54, št. 1/2, str. 39-54. [COBISS.SI-ID 8598617]