

UČNI NAČRT PREDMETA / COURSE SYLLABUS						
Predmet:		Algebraična topologija 2				
Course title:		Algebraic topology 2				
Študijski program in stopnja Study programme and level		Študijska smer Study field		Letnik Academic year	Semester Semester	
Magistrski študijski program Matematika		ni smeri		1 ali 2	prvi ali drugi	
Master's study programme Mathematics		none		1 or 2	first or second	
Vrsta predmeta / Course type				izbirni		
Univerzitetna koda predmeta / University course code:				M2311		
Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Klinične vaje work	Druge oblike študija	Samost. delo Individ. work	ECTS
30	15	30			105	6
Nosilec predmeta / Lecturer:		prof. Dušan Repovš, prof. Janez Mrčun, prof. Petar Pavešić, prof. Sašo Strle				
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:		
Vsebina:				Content (Syllabus outline):		
Kohomološke grupe, izrek o univerzalnih koeficientih. Kohomološki kolobar. Čechova kohomologija. Orientacija mnogoterosti, izreki				Cohomology groups, universal coefficients theorem. Cohomology ring. Čech cohomology. Orientation on manifolds, duality (Poincare -		

<p>o dualnosti (Poincare - Lefschetz, Alexander). Künnethov izrek, Bocksteinov homomorphism, transfer, kohomologija grup.</p> <p>Homotopske grupe, eksaktna zaporedja para in vlaknenja, Whiteheadov izrek, homotopski izrez. Hurewiczev izrek. Abstraktna homotopska teorija (H- in koH-prostori, Puppejeva zaporedja, spektri).</p>	<p>Lefschetz, Alexander). Künneth theorem, Bockstein homomorphism, transfer, group cohomology.</p> <p>Homotopy groups, exact sequence of a pair and of a fibration, Whitehead theorem, homotopy excision. Hurewicz theorem. Abstract homotopy theory (H- and coH-spaces, Puppe sequences, spectra).</p>
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Temeljni literatura in viri / Readings:

<p>A. Hatcher: Algebraic Topology, Ch. 3-4.</p> <p>W.Massey: A Basic Course in Algebraic Topology, Ch. XII-XV.</p> <p>E. Spanier: Algebraic Topology, Ch. 5-7.</p> <p>Dodatna:</p> <p>A. Dold: Lectures on Algebraic Topology, Ch. 7-8.</p> <p>P. May, A Concise Course in Algebraic Topology</p> <p>J. Munkres: Elements of Algebraic Topology, Ch. 5-8.</p> <p>R. Switzer: Algebraic Topology – Homotopy and Homology</p>

Cilji in kompetence:

Objectives and competences:

Študent spozna osnovne pojme algebraične topologije kot so homotopija, celični prostori, homotopske grupe in kohomološke grupe.

Student learns basic concepts of algebraic topology: homotopy, cellular spaces, homotopy groups and cohomology groups.

Predvideni študijski rezultati:

Znanje in razumevanje:

Poznavanje osnovnih pojmov in tehnik za delo s homotopskimi in kohomološkimi grupami. Razumevanje homotopske invariance in prijemov za obravnavanje geometrijskih vprašanj s pomočjo algebre.

Uporaba:

V področjih matematike, ki delajo z geometričnimi objekti (kompleksna in globalna analiza, dinamični sistemi, geometrijska in diferencialna topologija, teorija grafov), v računalništvu (grafika, prepoznavanje vzorcev, topološka analiza podatkov, robotika), v teoretični fiziki.

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.

Intended learning outcomes:

Knowledge and understanding:

Basic concepts and techniques for the computation of homotopy and cohomology groups. Understanding of the concepts of homotopy invariance and of approaches to geometric problems by algebraic methods.

Application:

Parts of mathematics with strong geometric content (complex and global analysis, geometric and differential topology, graph theory), computer science (computer graphics, pattern recognition, topological data analysis, robotics), theoretical physics.

Reflection:

Understanding of theoretical concepts through examples and applications.

Transferable skills:

Recognition of algebraic structures in geometry, appropriate formulation of problems.

Metode poučevanja in učenja:

Learning and teaching methods:

predavanja, vaje, domače naloge, konzultacije	Lectures, exercises, homeworks, consultations
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Delež (v %) /

Načini ocenjevanja:

Weight (in %)

Assessment:

izpit iz vaj, izpit iz teorije pisni izpit, ustni izpit		exercise-based exam, theoretical knowledge exam written exam, oral exam
Ocene: 5 (negativno), 6-10 (pozitivno) (po Statutu UL)	50% 50%	Grading: 5 (fail), 6-10 (pass) (according to the Statute of UL)

Reference nosilca / Lecturer's references:

Janez Mrčun:

- MOERDIJK, Ieke, MRČUN, Janez. Introduction to foliations and Lie groupoids, (Cambridge studies in advanced mathematics, 91). Cambridge, UK: Cambridge University Press, 2003. IX, 173 str., ilustr. ISBN 0-521-83197-0 [COBISS.SI-ID 12683097]
- MOERDIJK, Ieke, MRČUN, Janez. Lie groupoids, sheaves and cohomology. V: EuroSchool PQR2003 on Poisson geometry, deformation quantisation and group representations, Université Libre de Bruxelles, June 13-17, 2003. GUTT, Simone (ur.), RAWNSLEY, John Howard (ur.), STERNHEIMER, Daniel (ur.). Poisson geometry, deformation quantisation and group representations, (London Mathematical Society lecture note series, ISSN 0076-0552, 323). Cambridge [etc.]: Cambridge University Press, cop. 2005, str. 147-272 [COBISS.SI-ID 13657689]
- MRČUN, Janez. Topologija, (Izbrana poglavja iz matematike in računalništva, 44). Ljubljana: DMFA - založništvo, 2008. VI, 147 str., ilustr. ISBN 978-961-212-207-2 [COBISS.SI-ID 243021824]

Petar Pavešič:

- PAVEŠIČ, Petar CONNER, Gregory R., HERFORT, Wolfgang, PAVEŠIČ, Petar. Some anomalous examples of lifting spaces. Topology and its Applications, ISSN 0166-8641. [Print ed.], April 2018, vol. 239, str. 234-243.
- PAVEŠIČ, Petar, A topologist's view of kinematic maps and manipulation complexity. V: GRANT, Mark (ur.). Topological complexity and related topics : Mini-Workshop Topological Complexity and

Related Topics, February 28 - March 5, 2016, Mathematisches Forschungsinstitut Oberwolfach, Oberwolfach, Germany, (Contemporary mathematics, ISSN 0271-4132, 702). Providence: American Mathematical Society.

– PAVEŠIĆ, Petar. Splošna topologija, (Izbrana poglavja iz matematike in računalništva, 43). Ljubljana: DMFA - založništvo, 2008. VI, 89 str., ilustr. ISBN 978-961-212-205-8 [COBISS.SI-ID 240425984]

Dušan Repovš:

– BANAKH, Taras, REPOVŠ, Dušan. Direct limit topologies in the categories of topological groups and of uniform spaces. Tohoku mathematical journal, ISSN 0040-8735, 2012, vol. 64, no. 1, str. 1-24 [COBISS.SI-ID 16215897]

– CÁRDENAS, Manuel, LASHERAS, Francisco F., QUINTERO, Antonio, REPOVŠ, Dušan. On manifolds with nonhomogeneous factors. Central European Journal of Mathematics, ISSN 1895-1074, 2012, vol. 10, no. 3, str. 857-862 [COBISS.SI-ID 16241753]

– KARIMOV, Umed H., REPOVŠ, Dušan. On generalized 3-manifolds which are not homologically locally connected. Topology and its Applications, ISSN 0166-8641. [Print ed.], 2013, vol. 160, iss. 3, str. 445-449 [COBISS.SI-ID 16558681]

– CENCELJ, Matija, REPOVŠ, Dušan. Topologija, (Zbirka Pitagora). 1. ponatis. Ljubljana: Pedagoška fakulteta, 2011. XVI, 169 str., ilustr. ISBN 978-86-7735-051-2 [COBISS.SI-ID 254230528]

Sašo Strle:

– STRLE, Sašo. Bounds on genus and geometric intersections from cylindrical end moduli spaces. Journal of differential geometry, ISSN 0022-040X, 2003, vol. 65, no. 3, str. 469-511 [COBISS.SI-ID 13135193]

– OWENS, Brendan, STRLE, Sašo. A characterisation of the $n < 1 > [oplus] < 3 >$ form and applications to rational homology spheres. Mathematical research letters, ISSN 1073-2780, 2006, vol. 13, iss. 2, str. 259-271 [COBISS.SI-ID 13873241]

– OWENS, Brendan, STRLE, Sašo. Rational homology spheres and the four-ball genus of knots. Advances in mathematics, ISSN 0001-8708, 2006, vol. 200, iss. 1, str. 196-216 [COBISS.SI-ID 13875033]

