

UČNI NAČRT PREDMETA / COURSE SYLLABUS (leto / year 2017/18)						
<b>Predmet:</b>		Algebraična topologija 2				
<b>Course title:</b>		Algebraic topology 2				
<b>Študijski program in stopnja</b> Study programme and level		<b>Študijska smer</b> Study field		<b>Letnik</b> Academic year		<b>Semester</b> 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
<b>Vrsta predmeta / Course type</b>				izbirni / elective		
<b>Univerzitetna koda predmeta / University course code:</b>				M2311		
<b>Predavanja</b> Lectures	<b>Seminar</b> Seminar	<b>Vaje</b> Tutorial	<b>Klinične vaje</b> work	<b>Druge oblike študija</b>	<b>Samost. delo</b> Individ. work	<b>ECTS</b>
30	15	30			105	6
<b>Nosilec predmeta / Lecturer:</b>		prof. dr. Janez Mrčun, prof. dr. Petar Pavešič, prof. dr. Dušan Repovš, prof. dr. Sašo Strle				
<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>		

<p>Kohomološke grupe, izrek o univerzalnih koeficientih. Kohomološki kolobar. Čechova kohomologija. Orientacija mnogoterosti, izreki 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>Cohomology groups, universal coefficients theorem. Cohomology ring. Čech cohomology. Orientation on manifolds, duality (Poincare - 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>
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### Cilji in kompetence:

<p>Študent spozna osnovne pojme algebraične topologije kot so homotopija, celični prostori, homotopske grupe in kohomološke grupe.</p>
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### Objectives and competences:

<p>Student learns basic concepts of algebraic topology: homotopy, cellular spaces, homotopy groups and cohomology groups.</p>
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### Predvideni študijski rezultati:

<p>Znanje in razumevanje:</p> <p>Poznavanje osnovnih pojmov in tehnik za delo s homotopskimi in kohomološkimi grupami.</p>
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### Intended learning outcomes:

<p>Knowledge and understanding:</p> <p>Basic concepts and techniques for the computation of homotopy and cohomology</p>
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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.

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:**

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):
izpit iz vaj	50%	written exam
ustni izpit		oral exam

Ocene: 1-5 (negativno), 6-10 (pozitivno) (po Statutu UL)		Grading: 1-5 (fail), 6-10 (pass) (according to the Statute of UL)
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**Reference nosilca / Lecturer's references:**

Petar Pavešič:

PAVEŠIČ, Petar. The Hopf invariant one problem, (Podiplomski seminar iz matematike, 23). Ljubljana: Društvo matematikov, fizikov in astronomov Slovenije, 1995. 65 str. ISBN 961-212-050-1. [COBISS.SI-ID 53969664]

PAVEŠIČ, Petar. Reducibility of self-homotopy equivalences. Proceedings. Section A, Mathematics, ISSN 0308-2105, 2007, vol. 137, iss 2, str. 389-413. [COBISS.SI-ID 14371929]

PAVEŠIČ, Petar, PICCININI, Renzo A. Fibrations and their classification, (Research and exposition in mathematics, vol. 33). Lemgo: Heldermann, cop. 2013. XIII, 158 str., ilustr. ISBN 978-3-88538-233-1. [COBISS.SI-ID 16616793]

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]

Sašo Strle:

OWENS, Brendan, STRLE, Sašo. A characterisation of the  $n \lt 1 \gt \oplus \lt 3 \gt$  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]

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]

Dušan Repovš:

HEGENBARTH, Friedrich, MURANOV, Jurij Vladimirovič, REPOVŠ, Dušan. Browder-Livesay filtrations and the example of Cappell and Shaneson. Milan journal of mathematics, ISSN 1424-9286, 2013, vol. 81, iss. 1, str. 79-97. [COBISS.SI-ID 16619097]

KARIMOV, Umed H., REPOVŠ, Dušan. Examples of cohomology manifolds which are not homologically locally connected. Topology and its Applications, ISSN 0166-8641. [Print ed.], 2008, vol. 155, iss. 11, str. 1169-1174. [COBISS.SI-ID 14678105]

REPOVŠ, Dušan, SKOPENKOV, Mikhail, SPAGGIARI, Fulvia. On the Pontryagin-Steenrod-Wu theorem. Israel journal of mathematics, ISSN 0021-2172, 2005, vol. 145, str. 341-348. [COBISS.SI-ID 13451353]