



Univerza v Mariboru

Fakulteta za naravoslovje
in matematiko

UČNI NAČRT PREDMETA / COURSE SYLLABUS

Predmet:	Topologija
Course title:	Topology

Študijski program in stopnja Study programme and level	Študijska smer Study field	Letnik Academic year	Semester Semester
Matematika, 3. stopnja		1.	2.
Mathematics, 3 rd cycle		1 st	2 nd

Vrsta predmeta / Course type

Univerzitetna koda predmeta / University course code:

Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Klinične vaje work	Druge oblike študija	Samost. delo Individ. work	ECTS
45					225	9

Nosilec predmeta / Lecturer:

Jeziki / Languages:
Predavanja / Lectures: Slovenski jezik; Slovene
Vaje / Tutorial:

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

Znanje temeljnih pojmov in rezultatov iz topologije (topološki prostori, zvezne preslikave).

Vsaka izmed naštetih obveznosti v načinih ocenjevanja mora biti opravljena s pozitivno oceno.

Pozitivna ocena pri sprotnih nalogah je pogoj za pristop k ustnemu izpitu.

Prerequisites:

Basic knowledge of fundamental notions and results of topology (topological spaces, continuous mappings).

Each of the mentioned commitments must be assessed with a passing grade.

Passing grade of the coursework is required for taking the oral exam.

Vsebina:

Pojmi iz splošne topologije: na primer homotopija, krovni prostori, svežnji, topološka dimenija, kategorije.

Teorija kontinuumov: dekompozicije kontinuumov, kvocienti (in njihova metrizabilnost), prerezne točke, ireducibilni kontinuumi, karakterizacije kontinuumov podobnih lokom, dendroiti, dendriti, pahljače.

Inverzne limite in posplošene inverzne limite: novejši rezultati in povezava s topološkimi dinamičnimi sistemi, vložitve prostorov v ravnino.

Topološki dinamični sistemi: zahtevnejši klasični rezultati in njihove aplikacije v moderni teoriji, CR-dinamični sistemi, Mahavierhevi dinamični sistemi.

Ergodična teorija: aplikacije rezultatov iz ergodike v moderni teoriji, dinamične lastnosti funkcij, ki ohranjajo Lebesgueovo mero.

Nekatere izmed teh tem so obdelane podrobneje, druge pa le na osnovni ravni. Pri izboru se upoštevajo interesi in raziskovalne usmeritve študentov.

Content (Syllabus outline):

Concepts from general topology: for example, homotopy, covering spaces, bundles, topological dimension, categories.

Continuum theory: decompositions of continua, quotients (and their metrizability), cut points, irreducible continua, characterizations of arc-like continua, dendroids, dendrites, fans.

Inverse limits and generalized inverse limits: recent results and their connection with topological dynamical systems, embeddings of spaces in the plane.

Topological dynamical systems: advanced classical results and their applications in modern theory, CR-dynamical systems, Mahavier dynamical systems.

Ergodic theory: applications of results from ergodic theory in modern theory, dynamical properties of functions that preserve Lebesgue measure.

Some of these topics are treated in greater detail, and some of them only at a basic level. The selection depends on students' interests and their research orientation.

Temeljni literatura in viri / Readings:

- C. R. F. Maunder, Algebraic topology. Dover Publications, 1980
- J. R. Munkres, Topology. A first course. Prentice-Hall, 1975
- S. B. Nadler, Jr., Continuum theory. An introduction. Marcel Dekker, 1992
- E. H. Spanier, Algebraic topology. McGraw-Hill, 1966

Dodatna literatura / Additional Readings:

- J. Dugundji, Topology, Allyn and Bacon, 1966
- Hatcher, Algebraic topology. Cambridge University Press, 2002
- J. Nagata, Modern dimension theory, Helderman Verlag, 1983
- W.T. Ingram, W. S. Mahavier: Inverse limits: from continua to chaos, Springer, New York, 2012

Cilji in kompetence:

- Doseči poglobljeno razumevanje teoretskih in metodoloških konceptov s področja topologije
- Razviti sposobnost samostojnega razvijanja novega znanja s področja topologije
- Razviti sposobnost za samostojno reševanje najzahtevnejših problemov iz topologije
- Razviti sposobnost izboljševanja znanih in odkrivanja novih rezultatov s področja topologije
- Zmožnost razvijanja kritične refleksije na področju topologije
- Razviti zmožnost vodenja najzahtevnejših znanstvenoraziskovalnih projektov s širšega področja topologije.

Objectives and competences:

- To achieve a deeper understanding of theoretical and methodological concepts of topology
- To develop the ability to independently develop new knowledge in the field of topology
- To develop the ability for solving the most challenging problems in topology
- To develop the ability of improving known results as well as obtaining new results in topology
- Ability to develop critical reflection in topology
- To develop the ability to lead the most challenging scientific research projects in the wider field of topology

Predvideni študijski rezultati:

Znanje in razumevanje:

- poznavanje temeljnih topoloških področij;
- razumevanje in uporaba zahtevnih pojmov iz topologije pri raziskovalnem delu.

Prenesljive/ključne spretnosti in drugi atributi:

- podlaga za raziskovalno delo na področju topologije;
- pridobljeno znanje za uporabo topologije na drugih matematičnih področjih.

Intended learning outcomes:

Knowledge and understanding:

- knowledge of fundamental topics in topology;
- understanding and applying complex concepts of topology into research.

Transferable/Key Skills and other attributes:

- a basis for research in topology;
- knowledge needed for applying topology to other mathematical areas.

Metode poučevanja in učenja:

- predavanja;
- konzultacije;
- samostojni študij.

Learning and teaching methods:

- lectures;
- consultations;
- self-study.

Načini ocenjevanja:	Delež (v %) / Weight (in %)	Assessment:
Sprotne naloge	50 %	Coursework
Teoretični izpit	50 %	Theoretical exam

Reference nosilca / Lecturer's references:

1. BANIČ, Iztok, TARANENKO, Andrej. Span of a graph : keeping the safety distance. *Discrete mathematics & theoretical computer science*. 2023, vol. 25, no. 1, 19 str. ISSN 1365-8050. DOI: [10.46298/dmtcs.9859](https://doi.org/10.46298/dmtcs.9859). [COBISS.SI-ID [148408835](https://www.cobiss.si/id/148408835)], [JCR]
kategorija: 1A3
2. BANIČ, Iztok, KAC, Teja. Mapping theorems for rigid continua and their inverse limits. *Qualitative theory of dynamical systems*. 2022, vol. 21, iss. 4, str. 1-29. ISSN 1575-5460. DOI: [10.1007/s12346-022-00647-1](https://doi.org/10.1007/s12346-022-00647-1). [COBISS.SI-ID [120844547](https://www.cobiss.si/id/120844547)], [JCR]
kategorija: 1A3
3. BANIČ, Iztok, GREENWOOD, Sina. A characterisation of the dimension of inverse limits of set-valued functions on intervals. *Fundamenta mathematicae*. 2020, vol. 249, no. 1, str. 1-19. ISSN 0016-2736. DOI: [10.4064/fm708-5-2019](https://doi.org/10.4064/fm708-5-2019). [COBISS.SI-ID [24853768](https://www.cobiss.si/id/24853768)], [JCR]
kategorija: 1A3
4. BANIČ, Iztok, ERCEG, Goran, KENNEDY, Judy A. The Lelek fan as the inverse limit of intervals with a single set-valued bonding function whose graph is an arc. *Mediterranean journal of mathematics*. Jun. 2023, vol. 20, iss. 3, article no. 159, 24 str. ISSN 1660-5446. DOI: [10.1007/s00009-023-02323-3](https://doi.org/10.1007/s00009-023-02323-3). [COBISS.SI-ID [148424195](https://www.cobiss.si/id/148424195)], [JCR]
kategorija: 1A2
5. BANIČ, Iztok, ČREPNIJAK, Matevž, KAC, Teja. Markov set-valued functions on compact metric spaces. *Glasnik matematički. Serija 3*. 2024, vol. 59, no. 1, str. 193-212. ISSN 0017-095X. [https://web.math.pmf.unizg.hr/glasnik/59.1/59\(1\)-09.pdf](https://web.math.pmf.unizg.hr/glasnik/59.1/59(1)-09.pdf), DOI: [10.3336/gm.59.1.09](https://doi.org/10.3336/gm.59.1.09). [COBISS.SI-ID [148424195](https://www.cobiss.si/id/148424195)]]

[201394179](#)], [[Odprti dostop](#), [JCR](#), [SNIP](#), [Scopus](#)]

kategorija: 1A3