Univerza v Mariboru
Fakulteta za naravoslovje
in matematiko

UČNI NAČRT PREDMETA / COURSE SYLLABUS	
Predmet:	**Diskretna matematika**
Course title:	**Discrete Mathematics**

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

Vrsta predmeta / Course type izbirni / elective

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: Boštjan Brešar

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

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

Poznanje temeljnih konceptov diskretne matematike: klasične in algebraične kombinatorike, teorije grafov, teorije načrtov. Poznavanje osnov linearne algebre, teorije grup, kombinatorike delno urejenih množic.

Prerequisits:

Basic knowledge of fundamental concepts of discrete mathematics: classical and algebraic combinatorics, graph theory, design theory. Knowledge of basic linear algebra, group theory, combinatorics of partially ordered sets.

Vsebina:	**Content (Syllabus outline):**
Teorija grafov: hamiltonskost, ravninskost, povezanost, podgrafi, neodvisnost, barvanja, krožna barvanja, dominacija, Vizingova domneva. Metrična teorija grafov: konveksnost, produkti in metrične škatle, metrično definirani razredi (delne kocke, ...), kanonična metrična reprezentacija. Algebraični vidiki diskretne matematike: faktorizacije in lastnost krajšanja, razlikovalno število, avtomorfizmi in homomorfizmi. Uporabe diskretne matematike: matematična kemija, biologija, računalništvo. Nekatere izmed teh tem so obdelane podrobneje, druge pa le na osnovni ravni. Pri izboru se upoštevajo interesi in raziskovalne usmeritve študentov.	Graph theory: hamiltonicity, planarity, connectivity, subgraphs, independence, colorings, circular colorings, domination, Vizing's conjecture. Metric graph theory: convexity, products and metric boxes, metrically defined classes (partial cubes, ...), canonical metric representation. Algebraic aspects of discrete mathematics: factorization and cancelation propery, distinguishing number, automorphisms and homomorphisms. Applications of discrete mathematics: mathematical chemistry, biology, computer science. Some of these topics are treated in greater details and the others just at a basic level. The selection depends on students' interests and their research orientation.

Temeljni literatura in viri / Readings:

- M. Aigner, Discrete Mathematics, American Mathematical Society, Providence, 2007.
- R. Diestel, Graph Theory, Third Edition, Springer, Berlin, 2005.
- P. Hell, J. Nešetril, Graphs and Homomorphisms, Oxford University Press, Oxford, 2004.
- W. Imrich, S. Klavžar, Product Graphs : Structure and Recognition, Wiley-Interscience, New York, 2000.
- J. H. van Lint, R. M. Wilson, A Course in Combinatorics, Cambridge University Press, Cambridge, 2001.
- J. Matoušek, J. Nešetril, Invitation to Discrete Mathematics, Oxford University Press, Oxford, 1998.
- D. B. West, Introduction to Graph Theory, Second Edition, Prentice Hall, Upper Saddle River, 2001.

Cilji in kompetence:	**Objectives and competences:**
• Doseči poglobljeno razumevanje teoretskih in metodoloških konceptov s področja diskretne matematike • Razviti sposobnost samostojnega razvijanja novega znanja s področja diskretne matematike • Razviti sposobnost za samostojno reševanje najzahtevnejših problemov iz diskretne matematike • Razviti sposobnost izboljševanja znanih in odkrivanja novih rezultatov s področja diskretne matematike • Zmožnost razvijanja kritične refleksije na področju diskretne matematike • Razviti zmožnost vodenja najzahtevnejših znanstvenoraziskovalnih projektov s širšega področja diskretne matematike.	• To achieve a deeper understanding of theoretical and methodological concepts of discrete mathematics • To develop the ability to independently develop new knowledge in the field of discrete mathematics • To develop the ability for solving the most challenging problems in discrete mathematics • To develop the ability of improving known results as well as obtaining new results in discrete mathematics • Ability to develop critical reflection in discrete mathematics • To develop the ability to lead the most challenging scientific research projects in the wider field of discrete mathematics

Predvideni študijski rezultati:	Intended learning outcomes:
Znanje in razumevanje: • poglobljeno razumevanje izbranih področij diskretne matematike; • poglobljena zmožnost uporabe diskretne matematike na drugih področjih. Prenesljive/ključne spretnosti in drugi atributi: • podlaga za raziskovalno delo na področju diskretne matematike; • pridobljeno znanje za uporabo diskretne matematike na drugih področjih.	Knowledge and understanding: • Deeper understanding of selected areas of discrete mathematics; • Deeper ability to use discrete mathematics in other areas. Transferable/Key Skills and other attributes: • a basis for research in discrete mathematics; • knowledge needed for applying discrete mathematics to other areas.

Metode poučevanja in učenja:	Learning and teaching methods:
• predavanja; • priprava seminarja; • konzultacije; • samostojni študij.	• lectures; • seminar work; • consultations; • self-study.

Načini ocenjevanja:	Delež (v %) / Weight (in %)	Assessment:
Seminarska naloga Teoretični izpit	50 % 50 %	Seminar paper Theoretical exam

Reference nosilca / Lecturer's references:

1. BREŠAR, Boštjan, HEDŽET, Jaka. Bootstrap percolation in strong products of graphs. *The Electronic journal of combinatorics*. [Online ed.]. 2024, vol. 31, iss. 4, article no. p4.35, 22 str. ISSN 1077-8926. https://www.combinatorics.org/ojs/index.php/eljc/article/view/v31i4p35, DOI: 10.37236/11826. [COBISS.SI-ID 215693827], [Odprti dostop, JCR, kategorija: 1A2

2. BREŠAR, Boštjan, YERO, Ismael G. Lower (total) mutual-visibility number in graphs. *Applied mathematics and computation*. [Print ed.]. Mar. 2024, vol. 465, [article no.] 128411, 11 str., ilustr. ISSN 0096-3003. https://www.sciencedirect.com/science/article/pii/S0096300323005805, DiRROS - Digitalni repozitorij raziskovalnih organizacij Slovenije, DOI: 10.1016/j.amc.2023.128411. [COBISS.SI-ID 169849091], [JCR] kategorija: 1A1

3. BREŠAR, Boštjan, HENNING, Michael A. Best possible upper bounds on the restrained domination number of cubic graphs. *Journal of graph theory*. Aug. 2024, vol. 106, iss. 4, str. 763–815, graf. prikazi. ISSN 0364-9024. https://onlinelibrary.wiley.com/doi/10.1002/jgt.23095, DiRROS - Digitalni repozitorij raziskovalnih organizacij Slovenije, DOI: 10.1002/jgt.23095. [COBISS.SI-ID 199137795], [JCR] kategorija: 1A2

4. BREŠAR, Boštjan, JAKOVAC, Marko, ŠTESL, Daša. Indicated coloring game on Cartesian products of graphs. *Discrete applied mathematics*. [Print ed.]. Jan. 2021, vol. 289, str. 320-326. DOI: 10.1016/j.dam.2020.11.007. [COBISS.SI-ID 41803267], [JCR]
kategorija: 1A3

5. BREŠAR, Boštjan, ŠTESL, Daša. The independence coloring game on graphs. *Quaestiones mathematicae*. [Print ed.]. 2021, vol. , no. , str. 1-22. DOI: 10.2989/16073606.2021.1947919. [COBISS.SI-ID 70914307], [JCR]
kategorija: 1A1