



Univerza v Mariboru

Fakulteta za naravoslovje  
in matematiko

### UČNI NAČRT PREDMETA / COURSE SYLLABUS

<b>Predmet:</b>	Diskretna matematika
<b>Course title:</b>	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, 3 <sup>rd</sup> cycle		1 <sup>st</sup>	2 <sup>nd</sup>

**Vrsta predmeta / Course type**

obvezni ali izbirni/compulsory or  
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:**

Sandi Klavžar

**Jeziki /**

**Languages:**

**Predavanja /**

**Lectures:**

**Vaje / Tutorial:**

Slovenski jezik; Slovene

**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.

**Prerequisites:**

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:**

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. Algebrski 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.

**Content (Syllabus outline):**

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 cancellation property, 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. Nešetřil, 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. Nešetřil, 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:**

- 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.

**Objectives and competences:**

- 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:**

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.

**Intended learning outcomes:**

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:**

- predavanja;
- priprava seminarja;
- konzultacije;
- samostojni študij.

**Learning and teaching methods:**

- lectures;
- seminar work;
- consultations;
- self-study.

Delež (v %) /

**Načini ocenjevanja:**

Weight (in %)

**Assessment:**

Način (pisni izpit, ustno izpraševanje, naloge, projekt):

- seminarsko predavanje;
- pisni izdelek;
- ustni izpit.

20 %  
30 %  
50 %

Type (examination, oral, coursework, project):

- seminar talk;
- written work;
- oral examination.

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

1. KLAUŽAR, Sandi, ZEMLJIČ, Sara Sabrina. Connectivity and some other properties of generalized Sierpiński graphs. *Applicable analysis and discrete mathematics*, ISSN 1452-8630, Oct. 2018, vol. 12, no. 2, str. 401-412. <http://pefmath.etf.rs/vol12num2/AADM-Vol12-No2-297-317.pdf>, doi: [10.2298/AADM170206009K](https://doi.org/10.2298/AADM170206009K). [COBISS.SI-ID [18473561](https://www.cobiss.si/id/18473561)], [JCR]

kategorija: 1A2

2. ALIZADEH, Yaser, KLAUŽAR, Sandi. On graphs whose Wiener complexity equals their order and on Wiener index of asymmetric graphs. *Applied mathematics and computation*, ISSN 0096-3003. [Print ed.], July 2018, vol. 328, str. 113-118. <https://doi.org/10.1016/j.amc.2018.01.039>, doi: [10.1016/j.amc.2018.01.039](https://doi.org/10.1016/j.amc.2018.01.039). [COBISS.SI-ID [18255705](https://www.cobiss.si/id/18255705)], [JCR]

kategorija: 1A1

3. MANUEL, Paul, KLAUŽAR, Sandi. A general position problem in graph theory. *Bulletin of the Australian Mathematical Society*, ISSN 0004-9727, Oct. 2018, vol. 98, iss. 2, str. 177-187. <https://doi.org/10.1017/S0004972718000473>, doi: [10.1017/S0004972718000473](https://doi.org/10.1017/S0004972718000473). [COBISS.SI-ID [18443609](https://www.cobiss.si/id/18443609)], [JCR]

kategorija: 1A3

4. KLAVŽAR, Sandi, MANUEL, Paul. Strong geodetic problem in grid like architectures. *Bulletin of the Malaysian Mathematical Sciences Society*, ISSN 0126-6705, July 2018, vol. 41, iss. 3, str. 1671-1680. <https://doi.org/10.1007/s40840-018-0609-x>, doi: [10.1007/s40840-018-0609-x](https://doi.org/10.1007/s40840-018-0609-x). [COBISS.SI-ID [18387033](#)], [JCR]

kategorija: 1A2

5. HENNING, Michael A., KLAVŽAR, Sandi. Infinite families of circular and Möbius ladders that are total domination game critical. *Bulletin of the Malaysian Mathematical Sciences Society*, ISSN 0126-6705, Oct. 2018, vol. 41, iss. 4, str. 2141-2149. <https://doi.org/10.1007/s40840-018-0635-8>, doi: [10.1007/s40840-018-0635-8](https://doi.org/10.1007/s40840-018-0635-8). [COBISS.SI-ID [18442329](#)], [JCR]

kategorija: 1A2