



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. ali 2.	1. ali 2. ali 4.
Mathematics, 3 rd Degree		1 st or 2 nd	1 st or 2 nd or 4 th

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
60					240	10

Nosilec predmeta / Lecturer:

Jeziki / Languages: **Predavanja / Lectures:**
Vaje / Tutorial:

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

Poznanje temeljnih konceptov diskretne matematike: klasične in algebrske 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:

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 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.

Intended learning outcomes:

Knowledge and understanding:

- Deeper understanding of selected areas of discrete mathematics;
- Deeper ability to use discrete mathematics in other areas.

Prenesljive/ključne spretnosti in drugi atributi:

- podlaga za raziskovalno delo na področju diskretne matematike;
- pridobljeno znanje za uporabo diskretne matematike na drugih področjih.

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)	Delež (v %) / Weight (in %)	Type (examination, oral, coursework, project):
• seminarsko predavanje;	20 %	• seminar talk;
• pisni izdelek;	30 %	• written work;
• ustni izpit.	50 %	• oral examination.

Reference nosilca / Lecturer's references:

IMRICH, Wilfried, KLAUŽAR, Sandi, RALL, Douglas F.. *Topics in graph theory : graphs and their Cartesian product*. Wellesley (Mass.): A. K. Peters, 2008. XIV, 205 str., ilustr. ISBN 978-1-56881-429-2. [COBISS.SI-ID [14965081](#)]

HAMMACK, Richard H., IMRICH, Wilfried, KLAUŽAR, Sandi. *Handbook of product graphs, (Discrete mathematics and its applications)*. Boca Raton; London; New York: CRC Press, cop. 2011. XVIII, 518 str., ilustr. ISBN 978-1-4398-1304-1. [COBISS.SI-ID [15916121](#)]

HINZ, Andreas M., KLAUŽAR, Sandi, MILUTINOVIĆ, Uroš, PETR, Ciril. *The tower of Hanoi - Myths and Maths*. Basel [etc.]: Birkhäuser, cop. 2013. XV, 335 str., ilustr. ISBN 978-3-0348-0236-9. ISBN 978-3-0348-0237-6. <http://dx.doi.org/10.1007/978-3-0348-0237-6>, doi: [10.1007/978-3-0348-0237-6](https://doi.org/10.1007/978-3-0348-0237-6). [COBISS.SI-ID [16565337](#)]

KLAUŽAR, Sandi. Structure of Fibonacci cubes: a survey. *Journal of combinatorial optimization*, ISSN 1382-6905, 2013, vol. 25, iss. 4, str. 505-522. <http://dx.doi.org/10.1007/s10878-011-9433-z>. [COBISS.SI-ID [16603737](#)]

KLAUŽAR, Sandi, SHPECTOROV, Sergey. Convex excess in partial cubes. *Journal of graph theory*, ISSN 0364-9024, 2012, vol. 69, no. 4, str. 356-369. <http://dx.doi.org/10.1002/jgt.20589>. [COBISS.SI-ID [16243033](#)]