



Univerza v Mariboru

Fakulteta za naravoslovje  
in matematiko

### UČNI NAČRT PREDMETA / COURSE SYLLABUS

<b>Predmet:</b>	Matematične osnove računalniških omrežij
<b>Course title:</b>	Mathematical Foundations of Computer Networks

Študijski program in stopnja Study programme and level	Študijska smer Study field	Letnik Academic year	Semester Semester
Matematika, 2. stopnja		1. ali 2.	1. ali 3.
Mathematics, 2 <sup>nd</sup> cycle		1. or 2.	1. or 3.

**Vrsta predmeta / Course type**

**Univerzitetna koda predmeta / University course code:**

Predavanja Lectures	Seminar Seminar	Sem. vaje Tutorial	Lab. vaje Laboratory work	Teren. vaje Field work	Samost. delo Individ. work	ECTS
45			30		135	7

**Nosilec predmeta / Lecturer:**

<b>Jeziki / Languages:</b>	<b>Predavanja / Lectures:</b>	<input type="text" value="SLOVENSKO/SLOVENE"/>
	<b>Vaje / Tutorial:</b>	<input type="text" value="SLOVENSKO/SLOVENE"/>

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

**Prerequisites:**

**Vsebina:**  
Matematične osnove in teorija računalniških omrežij: teorija grafov, usmerjevalni postopki, dodeljevanje frekvenc.  
Omrežni račun.  
Omrežno upravljanje in varnost.  
Kriptografija in varnost v omrežjih: uporaba teorije števil, klasični kriptografski algoritmi, kriptografija z javnimi ključi, digitalni podpisi.  
Petrijeve mreže in uporaba pri analizi računalniških omrežij.

**Content (Syllabus outline):**  
Mathematical principles and theory of computer networks: graph theory, routing algorithms, frequency assignment.  
Network calculus.  
Network management and security.  
Cryptography and network security: number theory, classical encryption algorithms, public-key cryptography, digital signatures.  
Application of Petri Nets to Communication Networks.

Modeliranje omrežnega prometa.  
Medomrežno povezovanje in zaščita: varnostni zid.

Network traffic modeling.  
Inter-network communications and security: firewall.

### Temeljni literatura in viri / Readings:

T. Vidmar: Računalniška omrežja in storitve, Atlantis, 1997.  
A. Kumar, D. Manjunath, and J. Kuri: Communication Networking: An Analytical Approach, Elsevier, 2004.  
James D. McCabe: Practical Computer Network Analysis and Design. Morgan Kaufmann Publishers, 1998.  
William Stallings: Cryptography and Network Security: Principles and Practice. Prentice Hall, 2003.  
J. Billington, M. Diaz, G. Rozenberg: Application of Petri Nets to Communication Networks. Springer, 1999.  
Thomas G. Robertazzi: Computer Networks and Systems. Springer-Verlag, 2000.  
W. Mao: Modern cryptography : theory and practice, Upper Saddle River, Prentice-Hall, 2004.

### Cilji in kompetence:

Poglobiti znanje iz matematičnih osnove, teorije in temeljnih koncepte računalniških omrežij. Nadgraditi znanja pridobljena pri drugih predmetih (diskretne matematiki, algoritmih,...) za potrebe računalniških omrežij.

### Objectives and competences:

Deepen the knowledge of mathematical theory and fundamental concepts of computer networks. Upgrade the knowledge obtained with other subjects (algorithms, discrete mathematics, ...) for computer networks.

### Predvideni študijski rezultati:

Znanje in razumevanje:

- Razumeti matematične principe in teorijo
- Poglobiti znanje iz algoritmov za usmerjanje ter algoritmov za dodeljevanje frekvenc.
- Poglobiti znanje iz osnov varnosti in zaščite podatkov v računalniških omrežjih

Prenesljive/ključne spretnosti in drugi atributi:

- Pridobljena znanja se prenašajo na druge z računalništvom povezane predmete.

### Intended learning outcomes:

Knowledge and Understanding:

- To understand mathematical principles and theory
- To deepen the knowledge of routing algorithms and frequency assignment algorithms.
- To deepen the knowledge of basics of network security
- To understand secure data transmission methods

Transferable/Key Skills and other attributes:

- The obtained knowledge is transferable to the other computer science oriented subjects.

### Metode poučevanja in učenja:

Predavanja  
Računalniške vaje

### Learning and teaching methods:

Lectures  
Computer exercises

**Načini ocenjevanja:****Assessment:**

	Delež (v %) / Weight (in %)	
<u>Sprotno preverjanje:</u> Pisni testi – teorija (3 do 5 pisnih testov na semester)	50%	<u>Mid-term testing:</u> Written tests – theory (from 3 to 5 written tests during the semester)
<u>Izpit:</u> Pisni izpit – praktični del	50%	<u>Exams:</u> Written exam – practical part
Vsaka izmed naštetih obveznosti mora biti opravljena s pozitivno oceno.		Each of the mentioned commitments must be assessed with a passing grade.
Opravljene sprotne obveznosti so pogoj za pristop k izpitu.		Passing grades of all mid-term testings are required for taking the exam.

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

1. ZHU, Enqiang, TARANENKO, Andrej, SHAO, Zehui, XU, Jin. On graphs with the maximum edge metric dimension. Discrete applied mathematics, ISSN 0166-218X. [Print ed.], March 2019, vol. 257, str. 317-324. <https://doi.org/10.1016/j.dam.2018.08.031>, doi: 10.1016/j.dam.2018.08.031. [COBISS.SI-ID 18584665]
2. PETERIN, Iztok, SCHREYER, Jens, FECKOVÁ ŠKRABUL'ÁKOVÁ, Erika, TARANENKO, Andrej. A note on the Thue chromatic number of lexicographic products of graphs. Discussiones mathematicae, Graph theory, ISSN 1234-3099, 2018, vol. 38, iss. 3, str. 635-643. <http://www.discuss.wmie.uz.zgora.pl/php/discuss3.php?ip=&url=pdf&nIdA=25507&nIdSesji=-1>, doi: 10.7151/dmgt.2032. [COBISS.SI-ID 18373465]
3. KELENC, Aleksander, KUZIAK, Dorota, TARANENKO, Andrej, YERO, Ismael G. Mixed metric dimension of graphs. Applied mathematics and computation, ISSN 0096-3003. [Print ed.], 2017, vol. 314, str. 429-438, doi: 10.1016/j.amc.2017.07.027. [COBISS.SI-ID 23331080]
4. BANIČ, Iztok, TARANENKO, Andrej. Measuring closeness of graphs - the Hausdorff distance. Bulletin of the Malaysian Mathematical Society, ISSN 0126-6705, 2017, vol. 40, iss. 1, str. 75-95, doi: 10.1007/s40840-015-0259-1. [COBISS.SI-ID 21722376]
5. KELENC, Aleksander, TARANENKO, Andrej. On the Hausdorff distance between some families of chemical graph. MATCH Communications in Mathematical and in Computer Chemistry, ISSN 0340-6253, 2015, vol. 74, no. 2, str. 223-246. [http://match.pmf.kg.ac.rs/electronic\\_versions/Match74/n2/match74n2\\_223-246.pdf](http://match.pmf.kg.ac.rs/electronic_versions/Match74/n2/match74n2_223-246.pdf). [COBISS.SI-ID 21391368]