UČNI NAČRT PREDMETA / COURSE SYLLABUS

Predmet:	Teorija kodiranja in kriptografija
Course title:	Coding theory and cryptography

Študijski program in stopnja Study programme and level	Študijska smer Study field	Letnik Academic year	Semester Semester
Univerzitetni študijski program Matematika	ni smeri	3	drugi
First cycle academic study programme Mathematics	none	3	second

Vrsta predmeta / Course type	izbirni

Univerzitetna koda predmeta / University course code:	M0216

Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Klinične vaje work	Druge oblike študija	Samost. delo Individ. work		ECTS
30		30			90		5

Nosilec predmeta / Lecturer:	prof. Arjana Žitnik, prof. Marko Petkovšek, prof. Primož Potočnik

Jeziki / Languages:	Predavanja / Lectures:	slovenski/Slovene
	Vaje / Tutorial:	slovenski/Slovene

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	Prerequisites:
Opravljena predmeta Algebra 2 in Uvod v programiranje.	Completed courses Algebra 2 and Introduction to programming.

Vsebina:	Content (Syllabus outline):

Teorija kodiranja. Informacija in entropija. Shannonova teorija. Kodi za popravljanje napak. Zgornje meje za število kodnih besed. Linearni, Hammingovi, ciklični in Reed-Mullerjevi kodi. Kriptografija. Klasična kriptografija. Sistemi z zasebnim ključem. RSA in sistemi z javnim ključem. Digitalni podpisi. Zgoščevalne funkcije. Distribucija in izmenjava ključev. Identificiranje, overjanje in delitev skrivnosti. Generiranje psevdo-naključnih števil. Dokazi z ničelno informacijo.	Coding theory. Information and entropy. Shannon's theory. Error-correcting codes. Bounds on the size of codes. Linear, Hamming, cyclic and Reed-Muller codes. Cryptography. Classical cryptography. Symmetric-key cryptosystems. RSA cryptosystem and public-key cryptography. Digital signatures. Hash functions. Key distribution and key agreement schemes. Identification, authentication, secret sharing schemes. Zero-knowledge proofs.

Temeljni literatura in viri / Readings:

D. R. Stinson: Cryptography : Theory and Practice, 3rd edition, Chapman &; Hall/CRC, Boca Raton, 2005.

J. Talbot, D. Welsh: Complexity and Cryptography, Cambridge Univ. Press, Cambridge, 2006.

D. Welsh: Codes and Cryptography, Oxford Univ. Press, Oxford, 1988.

Cilji in kompetence: / **Objectives and competences:**

Študent spozna osnove teorije kodiranja in kriptografije.	Students learn the basics of coding theory and cryptography.

Predvideni študijski rezultati: / **Intended learning outcomes:**

Znanje in razumevanje: Matematični postopki, s katerimi zagotavljamo zanesljivo in varno komunikacijo. Uporaba: Kodiranje in kriptografija se uporabljata pri digitalnih komunikacijah in za zagotavljanje informacijske varnosti. Refleksija: Osnovne tehnike sodobne kriptografije temeljijo na matematičnih pojmih in postopkih, ki zagotavljajo največjo znano mero varnosti.	Knowledge and understanding: Mathematical procedures that enable reliable and secure communication. Application: Coding theory and cryptography are used in digital communications and for providing information security.

Prenosljive spretnosti – niso vezane le na en predmet: Študent pridobi sposobnost kritičnega razmišljanja in analize komunikacijskih kanalov in računalniških sistemov s stališča informacijske varnosti.	Reflection: Basic techniques of modern cryptography are based on mathematical concepts and procedures that provide the maximum level of security known. Transferable skills: The students will acquire skills of critical thinking and analysys of the communication channels and computer systems with respect to information security.

Metode poučevanja in učenja:	**Learning and teaching methods:**

Predavanja, vaje, domače naloge, konzultacije	Lectures, exercises, homework, consultations

Načini ocenjevanja:	Delež (v %) / Weight (in %)	**Assessment:**
Način (pisni izpit, ustno izpraševanje, naloge, projekt): 2 kolokvija namesto izpita iz vaj, izpit iz vaj, izpit iz teorije ocene: 1-5 (negativno), 6-10 (pozitivno) (po Statutu UL)	50% 50%	Type (examination, oral, coursework, project): 2 midterm exams instead of written exam, written exam oral exam grading: 1-5 (fail), 6-10 (pass) (according to the Statute of UL)

Reference nosilca / Lecturer's references:

Marko Petkovšek:

– PETKOVŠEK, Marko. Symbolic computation with sequences. Programming and computer software, ISSN 0361-7688, 2006, vol. 32, no. 2, str. 65-70 [COBISS.SI-ID 15287129]

– ABRAMOV, Sergei A., PETKOVŠEK, Marko. On the bottom summation. Programming and computer software, ISSN 0361-7688, 2008, vol. 34, no. 4, str. 187-190 [COBISS.SI-ID 15287385]

– PETKOVŠEK, Marko, ZAKRAJŠEK, Helena. Enumeration of I-graphs: Burnside does it again. Ars mathematica contemporanea, ISSN 1855-3966. [Tiskana izd.], 2009, vol. 2, no. 2, str. 241-262 [COBISS.SI-ID 15497049]

Primož Potočnik:

– POTOČNIK, Primož. B-groups of order a product of two distinct primes. Mathematica slovaca, ISSN 0139-9918, 2001, vol. 51, no. 1, str. 63-67 [COBISS.SI-ID 10617433]

– POTOČNIK, Primož, VERRET, Gabriel. On the vertex-stabiliser in arc-transitive digraphs. Journal of combinatorial theory. Series B, ISSN 0095-8956, 2010, vol. 100, iss. 6, str. 497-509 [COBISS.SI-ID 15680601]

– POTOČNIK, Primož, SPIGA, Pablo, VERRET, Gabriel. On the nullspace of arc-transitive graphs over finite fields. Journal of algebraic combinatorics, ISSN 0925-9899, 2012, vol. 36, no. 3, str. 389-401 [COBISS.SI-ID 16162137]

Arjana Žitnik:

– KAVČIČ, Urška, MUCK, Tadeja, LOZO, Branka, ŽITNIK, Arjana. Readability of multi-colored 2D codes. Technics tehnologies education management, ISSN 1840-1503, 2011, vol. 6, no. 3, str. 622-630, ilustr [COBISS.SI-ID 2673008]

– JURIŠIĆ, Aleksandar, TERWILLIGER, Paul, ŽITNIK, Arjana. The Q-polynomial idempotents of a distance-regular graph. Journal of combinatorial theory. Series B, ISSN 0095-8956, 2010, vol. 100, iss. 6, str. 683-690 [COBISS.SI-ID 15688537]

– CONDER, Marston D. E., PISANSKI, Tomaž, ŽITNIK, Arjana. GI-graphs: a new class of graphs with many symmetries. Journal of algebraic combinatorics, ISSN 0925-9899, 2014, vol. 40, iss. 1, str. 209-231. [COBISS.SI-ID 16969561]